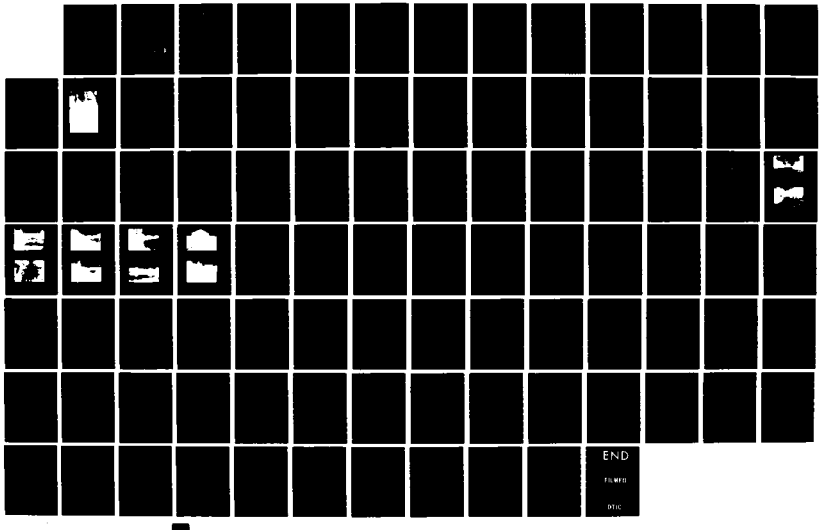
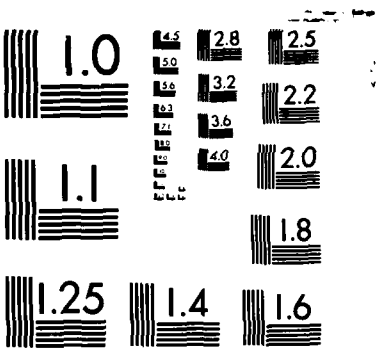
AD-A157 629 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS ST ALBANS RESERVOIR D..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV SEP 78 1/1

UNCLASSIFIED F/G 13/13 NL

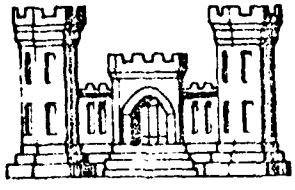




RICHELIEU RIVER BASIN
FAIRFAX

ST. ALBANS RESERVOIR DAM (NORTH)
VT 00058

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

SEPTEMBER 1978

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER VT 00058	2. GOVT ACCESSION NO. AD-A157 629	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) St. Albans Reservoir Dam (North) NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE September 1978 13. NUMBER OF PAGES 46
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Richélieu River Basin
Fairfax VT.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

THe dam is an earthfill dam about 1200 ft. long and 22 ft. high. It is small in size with a high hazard potential. The dam is judged to be in fair condition. There were several significant conditions noted. There are various remedial measures and recommendations which should be implemented by the owner.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED-E

JUN 11 1979

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

I am forwarding for your use a copy of the St. Albans Reservior Dam (North) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment which emphasizes the inadequacy of the project spillway under test flood conditions is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the St. Albans Reservoir Dam (North) would likely be exceeded by floods greater than 15 percent of half the Probable Maximum Flood (1/2 PMF), the test flood for spillway adequacy. Screening criteria for initial review of spillway adequacy specifies that this class of dam, having insufficient spillway capacity to discharge the 1/2 PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations there appears to be a serious deficiency in spillway capacity. This could render the dam unsafe in the event of a severe storm which would likely cause overtopping and possible failure of the dam, significantly increasing the hazard potential for loss of life downstream from the dam.

NEDED-E
Honorable Richard A. Snelling

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy preciptiation, round-the-clock surveillance should be provided.

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Water Resources, the cooperating agency for the State of Vermont This report has also been furnished to the owner of the project, the City of St. Albans, St. Albans, Vermont 05478, ATTN: City Engineer.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Water Resources for the cooperation extended in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

ST. ALBANS RESERVOIR DAM (NORTH)

VT00058

FAIRFAX, VERMONT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: VT00058
Name of Dam: St. Albans Reservoir Dam (North)
Town: Fairfax
County and State: Franklin County, Vermont
Stream: Unknown
Date of Inspection: August 3, 1978

BRIEF ASSESSMENT

The St. Albans Reservoir Dam (North) is an earthfill dam, approximately 1200 feet long with a maximum height of approximately 22 feet. The dam serves as a drinking water supply for the City of St. Albans. Appurtenant to the dam is an intake and gate house, and a concrete spillway channel. Located just below the dam is the St. Albans Water Treatment Plant.

The high water level in the reservoir is controlled by the concrete spillway. Based on a size classification of "small" and a hazard classification of "high" (See Section I) in accordance with "Recommended Guidelines for Safety Inspection of Dams, Department of the Army, November 1976" the test flood for this dam is 1/2 the Probable Maximum Flood (P.M.F.). The test flood of 1/2 PMF, in this case 2430 cfs, overtops the dam by 1.5 feet. The spillway has a capacity without overtopping of 15.2% of the test flood. The drainage area for the dam is 1.8 square miles, with a normal impoundment surface area of 35 acres.

The dam is judged to be in fair condition. The following significant conditions were observed:

1. An active seep was found on the downstream face of the dam. The downstream slope of the dam in this area is unusually steep - 1.5H to 1V.

2. Within the last 10-15 years the dam has become heavily overgrown with brush and trees.

3. The dam has the potential of being overtopped by as much as 1.5 feet during the test flood of 1/2 PMF.

A detailed assessment and recommendations for remedial measures are contained in Chapter 7. In summary, it is recommended that the following investigations, and designs be prepared by a qualified engineer and that a contractor be hired to make the necessary repairs.

1. Investigation of the seep, and of seepage control measures.

2. Investigation of the materials forming the dam and analysis of the stability of the dam.

3. Investigate alternatives for protecting the dam from overtopping.

In addition, the Owner should implement a systematic maintenance program consisting of the following items:

1. Removal of trees and brush from the dam.

2. Plant and maintain grass on the downstream slope of the dam.

3. Patch and repair the concrete in the spillway.

4. Operate the valve in the gatehouse periodically.

John R. Spencer

This Phase I Inspection Report on St. Albans Reservoir Dam (North) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines and Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

SECTION 6: STRUCTURAL STABILITY

Evaluation of Structural Stability

a. Visual Observations

A possible stability problem was indicated by the active seep on the downstream slope of the dam. The seep area extending up to 8 feet above the toe showed at the time of the inspection a small amount of downslope movement. The downstream slope is very steep for an earth dam (about 1.5H to 1.0V). Such a slope is relatively more susceptible to erosion because the soil can move downslope more easily and also because the seepage paths are shorter than for an earth dam with conventional flatter slopes.

b. Design and Construction Data

The data available did not contain information about the cross section of the dam or the zonation and materials used to construct the dam. The high exit point of the observed seep is consistent with an homogeneous cross section with no internal drainage.

c. Operating Records

The records of previous inspections indicated the presence of wet areas along the toe of the dam but not of wet areas on the slope.

d. Post-Construction Changes

None of the available records indicate post-construction changes.

e. Seismic Stability

The dam is located in seismic zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

No design data for the dam or spillway were available.

b. Experience Data

There are no records of high flow conditions at the site.

c. Visual Observations

The crest of the dam is irregular so that should overtopping occur, the low spots would be subjected to greater flow velocities and would increase the possibility of eroding a channel in the dam face. In addition, outflow from the dam must pass beneath State Route 104. A potential danger to the road exists at this location.

d. Overtopping Potential

Preliminary computations of the overtopping potential indicate that during the test flood (1/2 PMF), the spillway would not be capable of passing the discharge. The dam will overtop when the water surface elevation is greater than 749.5 feet MSL. The test flood water surface elevation is 751 feet MSL and would result in a maximum 1.5 foot surcharge over the dam. The average surcharge for the test flood is 0.7 feet MSL with approximately 960 feet of the dam being overtopped. Discharge for the test flood is 2530 cfs (1400 csm).

e. Dam-Break Flood

Analysis of the flood wave that would be generated by a dam burst was based on engineering judgment. Assuming a flood wave of two-thirds the height of the dam, a wave 15 feet high would be produced. Failure of this dam would probably result in major damage to Bridge 15 or State Route 104, 1500 feet downstream of the dam. While severance of the highway would not isolate anyone, the road is the prime route between St. Albans and Fairfax. Severe erosional damage would probably result at the treatment plant building which could result in at least temporary termination of its operation. Also, the lower reservoir could be damaged and possibly fail as well as a result of the North Reservoir bursting.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level in the North Reservoir is maintained as high as possible by pumping out of the South Reservoir into the North Reservoir during dry periods. Approximately 4 million gallons of drinking water is withdrawn from the reservoir per day.

4.2 Maintenance of Dam

The only maintenance of the dam consists of mowing the crest of the dam from the Town road to the gatehouse.

4.3 Maintenance of Operating Facilities

The only maintenance of the operating facilities consists of cleaning the intake screens in the gatehouse.

4.4 Description of Warning System in Effect

None exists for this dam.

4.5 Evaluation

The maintenance presently being performed is insufficient to insure the safety of the dam. Recommendations for a maintenance program are outlined in Chapter 7.

set of relatively coarse screens to prevent fish and debris from entering the intake. The gatehouse is about 15 feet off-shore from the normal high water line. A concrete plank supported on railroad tracks provides access to the gatehouse.

The spillway channel carries water from the spillway crest, over the face of the dam and into a channel leading to the South Reservoir. The spillway channel is paved with concrete, and is in fair condition, especially considering its age. Cracking, weathering and some movement of the concrete paving has taken place, particularly along the construction joints. For the most part the cracks have been repaired with asphalt patch. There was one hole observed in the concrete paving (8-inch diameter) towards the lower section of the spillway.

The concrete retaining walls on either side of the spillway are also in fair condition. In several areas the retaining walls show evidence of lateral movement. There are trees and bushes growing next to the wall with branches overhanging the channel. A large willow tree growing out of the upstream slope of the dam has fallen across the spillway entrance and can present an obstruction to the flow.

d. Reservoir Area

The reservoir area is 35 acres at normal pool level (elevation 745). The surface area was assumed to increase at a rate of 1.07 acres per foot of increase in water surface elevation.

e. Downstream Channel

The downstream channel is concrete lined with laid-up stone sides. It was clear of obstructions and in generally good condition on the day of the inspection.

3.2 Evaluation

The dam is judged to be in fair condition. The seeps observed in the downstream face of the dam and the unchecked growth of trees on the downstream slope and crest can impair the safety of the dam in the near future. The significance of the seeps as it relates to the stability of the dam is discussed in Section 6.

Continued maintenance on the appurtenant structures is required to insure their safety. Specific maintenance items are detailed in Chapter 7.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The dam is judged to be in fair condition. An active seep was found on the downstream face. The upstream and downstream were found to be overgrown with trees, and the downstream face was unusually steep.

b. Dam

The exposed part of the upstream face of the dam consists of a vertical stone wall 5 to 6 feet in height below which there is a riprap covered slope. The stone wall is in good condition. Several willow trees with trunk diameters of up to 18 inches have grown out of the upstream slope and are now dying.

The crest of the dam is about 18 feet wide as measured next to the gatehouse. The crest is mowed between the road and the gatehouse. Between the gatehouse and the right abutment, there is a heavy growth of bushes and trees along the crest. No signs of erosion or cracks were observed.

The inclination of the downstream slope was measured near the gatehouse, and it is about 1.5H to 1.0V. There is a heavy growth of large trees and bushes while the ground surface is practically bare. The trees have trunk diameters up to about 12 inches. When walking on the slope, the ground surface appears soft. The soil exposed at the surface is a slightly organic silty sand or sandy silt. The ground surface at the toe of the dam and on the slope up to an elevation of about 8 feet above the toe is wet in an area opposite the gatehouse and for a distance of about 25 feet to the right. Although the rate of flow is small, there are some indications of downslope soil movement. At the location of the seep, the dam is about 22 feet high.

c. Appurtenant Structures

There are two structures appurtenant to the dam: the gatehouse and intake structure, and the spillway. The gatehouse is a brick masonry building which appears to have been constructed at the same time as the dam. Insie the gatehouse is the original intake to the water system which reportedly consists of a 16-inch elbow and gate valve. The gate valve has not been operated for several years. Incorporated into the upstream wall of the gatehouse, below the water level, are a

SECTION 2: ENGINEERING DATA

2.1 Design

There is no design information available for this dam.

2.2 Construction

There is no information on the construction other than the date of construction - 1895.

2.3 Operation

In general the operation of the dam involves keeping the reservoir level as high as possible. When the inflow into the reservoir is insufficient to keep the reservoir full, water is pumped from the South Reservoir into the North Reservoir.

2.4 Evaluation

a. Availability

The design and construction records for this dam are not available.

b. Adequacy

The lack of in-depth engineering data does not allow for a definitive review. Therefore the adequacy of this dam, structurally and hydraulically, cannot be assesed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history and sound hydrologic and hydraulic engineering judgment.

c. Validity

Not applicable.

(5) Side Slopes

Upstream: 2.0H to 1.0 feet
Downstream: 1.5H to 1.0 feet

(6) Zoning

None known.

(7) Impervious Core

None known.

(8) Cutoff

None known.

(9) Grout Curtain

None known.

i. Spillway

The spillway is a concrete chute spillway, 450 feet in length and varying in width from 25 to 28 feet. The sidewalls of the chute vary from 1.4 to 4.7 feet in height and are concrete except for a 100-foot section of laid-up stone wall midway along the inside wall. The spillway crest is a triangular weir 27 feet in length and located at elevation 746.8 feet MSL.

Directly downstream of the spillway, the flow passes through a 17 x 5 foot pipe arch beneath State Route 104, and enters the southern reservoir.

j. Regulating Outlets

A 15" CMP conduit passes through the dam below the gate house. The pipe serves as a drain for the reservoir, but due to its size would not affect flood levels. A 16" supply line to the treatment building also exists. This pipe would also not affect flood levels.

3. Spillway Capacity

The capacity of the spillway at a reservoir elevation of 749.5 feet above MSL (the point at which the dam will overtop) is 385 cfs.

c. Elevation Data

	Elevation (feet above MSL)
Top of Dam (Maximum)	753.5
Test Flood (1/2 PMF)	751
Top of Dam (Minimum)	749.5
Spillway Crest	746.75
Normal Pool	745
Streambed at Centerline of Dam	±718

d. Reservoir Data

	Feet
Length of Test Flood Pool	2600+
Length of Normal Pool	2500

e. Storage Data

	Acre-Feet
Test Flood (1/2 PMF)	1168+
Top of Dam (Minimum)	1089+
Normal Pool	850

f. Reservoir Surface Area

	Acres
Test Flood (1/2 PMF)	41.5+
Top of Dam (Minimum)	40+
Normal Pool	35

g. Dam

(1) Type

Earth dam.

(2) Length

1200 feet (approximately)

(3) Height

22 feet.

(4) Top Width

18 feet.

g. Purpose

The St. Albans Reservoir is the primary water source for the City of St. Albans.

h. Design and Construction History

St. Albans Reservoir (North) was constructed in 1895 to augment the water stored in the St. Albans Reservoir (South). Originally water could be piped from the North Reservoir directly into the water system, or into the South Reservoir. In 1970 a water filtration plant was constructed just downstream of the dam. Presently water is piped from the North Reservoir directly to the filtration plant.

i. Normal Operation Procedure(s)

The operation is an integral part of the operation of the water filtration plant. The North Reservoir feeds directly into the filtration plant and is the primary water supply. When the level in the North Reservoir drops, water is pumped from the South Reservoir back up into the North Reservoir.

1.3 Pertinent Data

a. Drainage Area

The drainage basin of the northern St. Albans Reservoir lies within the towns of Fairfax, Fairfield and St. Albans, Vermont. The basin encompasses approximately 1.8 square miles and is roughly oval shaped with a general north-south trend.

The predominant soils within the drainage basin belong to the Lyman-Marlow-Peru, and the Marlow-Peru associations. These are soils which were formed in the upland glacial tills. Hydrologically, these soils can be classified as C soils.

The major water course within the drainage basin is an unnamed tributary to the Mill River.

b. Discharge at the Dam Site

1. Outlet Works

The primary outlet for the reservoir is a concrete chute spillway located at the western end of the main earthfill portion of the dam. In addition to the spillway, water can be released by means of a gated 15" CGMP which acts as a drain for the reservoir. Also, water can pass from a 16" pipe directly into the treatment plant.

2. Maximum Known Flood at Dam Site

No records nor recollections of any flooding having occurred at the site could be found.

slope. With the exception of a portion of the crest of the dam, both the upstream and downstream face of the dam are thickly overgrown with relatively new (5-20 years) growth.

There are two structures appurtenant to the dam. A brick gate-house houses the coarse screens, 16-inch valve and pipe elbow which constitute the intake to the water system. A concrete weir and spillway channel leading from the North Reservoir to the South reservoir carries the reservoir outflow during periods of high runoff. In addition there is a 12-inch pipe from the South Reservoir pump house which penetrates the dam near the left abutment. This pipe allows water to be pumped up from the South Reservoir to the North Reservoir.

c. Size Classification

St. Albans Reservoir Dam (North) impounds approximately 35 acres of water. The height of the dam is 22 feet. The normal pool storage volume is estimated to be 850 acre-feet although the dam is capable of storing about 1090 acre-feet of water just prior to overtopping. The Army Corps of Engineers recommends that dams having a storage volume of greater than 50 acre-feet but less than 1000 acre-feet and a height of more than 25 feet but less than 45 feet be classified as small. Although this dam may, just prior to overtopping, store slightly in excess of 1000 acre-feet it is classified as small due to the relatively low dam height and the fact that normal pool storage is below 1000 acre-feet.

d. Hazard Classification

A failure of St. Albans Reservoir (North) would immediately destroy the St. Albans water treatment plant, and potentially several houses adjacent to Route 104. Using engineering judgment it is predicted that failure of the North Reservoir would result in failure of the South Reservoir as well. The resulting flood wave would have the potentiality of causing the loss of more than twelve lives, and of causing serious damage to more than six homes. The hazard category is therefore high.

e. Ownership

The owner of the St. Albans Reservoir (North) is:

The City of St. Albans
St. Albans Water Department
St. Albans, Vermont 05478

Attention: City Manager

f. Operator

The dam is operated by the St. Albans Water Department. Contact Mr. William Scott, Public Works Director, City Hall, St. Albans, Vermont 05478. Telephone 802-524-4830.

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: ST. ALBANS RESERVOIR DAM (NORTH)

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of May 26, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0341 has been assigned by the Corps of Engineers for this work.

b. Purpose

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of dams.

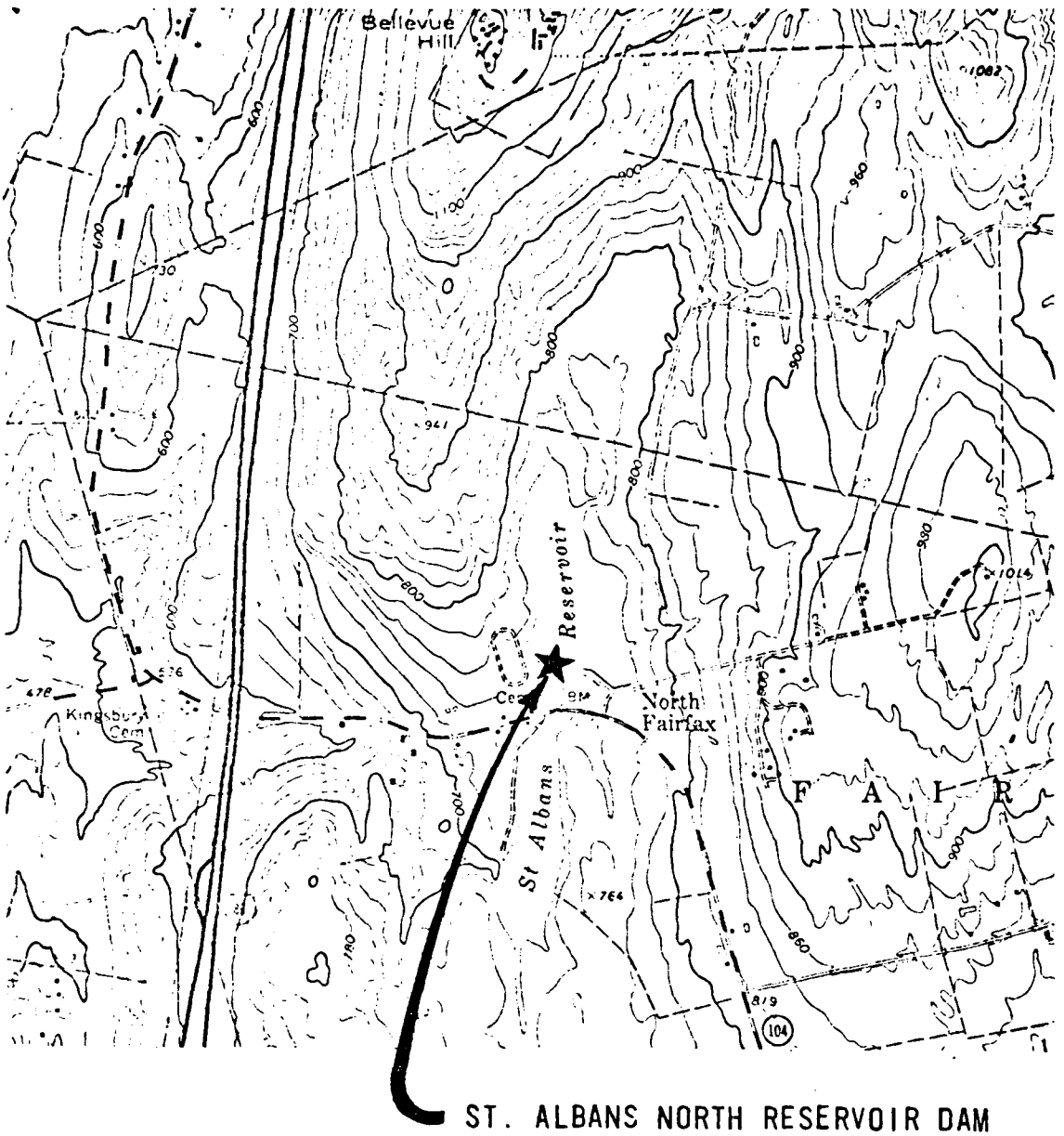
1.2 Description of Project

a. Location

The St. Albans Reservoir is located in the Town of Fairfax, Franklin County, Vermont. The reservoir is about 3.5 miles south of St. Albans on Route 104, and is tributary to the Mill River.

b. Description of Dam and Appurtenances

The St. Albans Reservoir Dam is an earthfill dam which creates an impoundment which serves as the primary drinking water source for the City of St. Albans. The dam is riprapped on the upstream



MAP SOURCE:

U.S. GEOLOGICAL SURVEY
ST. ALBANS QUADRANGLE
VERMONT
7.5 MIN SERIES
1:2400 1964

CLIENT NO	22-0556	DUFRESNE-HENRY ENGINEERING CORP.	
PROJ ENG	MRP	LOCATION MAP	
DRAWN BY	RB	ST. ALBANS NORTH RESERVOIR	
DATE	9-8-78	FAIRFAX VERMONT	A 6014

AERIAL PHOTOGRAPH

ST. ALBANS NORTH RESERVOIR DAM

FAIRFAX, VERMONT

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The visual inspection and operational record indicate that the dam is in fair condition. This condition, however, is judged to be deteriorating rapidly, due largely to lack of maintenance. The two areas of major concern in the near future are:

1. The seeps downslope movement on the downstream slope which could worsen and become a mode of failure for the dam.

2. The unchecked growth of trees on the downstream slope, crest, and upper part of the upstream slope. Rotting roots of dead trees can create channels for seepage through the dam.

b. Adequacy of Information

The information available on the design and construction of the dam is practically nil and thus assessment of the dam is based primarily on visual inspection.

c. Urgency

The recommendations presented in Section 7.2 concerning the seepage studies should be acted upon within one year of receipt of this Phase I Inspection Report.

d. Necessity for Additional Investigation

The owner should perform the additional investigations recommended in Section 7.2.

7.2 Recommendations

It is recommended that an engineer qualified in the design of earth dams be engaged to investigate and design the items listed below and that a contractor be hired to construct the recommended improvements in accordance with the design.

a. The significance of the seep and the stability of the embankment should be investigated. Seepage control measures such as a toe drain or a downstream pervious shell should be considered to reduce or eliminate the danger of piping.

b. Investigate and recommend the most feasible alternative for protecting the dam from overtopping.

7.3 Remedial Measures

a. Alternatives

Not applicable.

b. Operating and Maintenance Procedures

1. The following items should be incorporated into a systematic dam maintenance program to be performed by the owner.

   (a) The trees and bushes growing on the dam should be removed periodically. The tree removal program should include those at the spillway entrance and immediately adjacent to the spillway channel.

   (b) Grass should be planted and maintained on the downstream slope. It is expected that due to the steepness of the downstream slope, special precautions will be required to prevent erosion while the grass cover becomes established.

   (c) The spillway paving should be maintained by patching as required. Holes in the spillway should be repaired to prevent erosion and undermining of the channel during heavy flow. The sections of the spillway retaining walls which have moved significantly out of alignment should be relocated or replaced.

   (d) The valve in the gatehouse should be kept in an operating condition.

2. A system for warning downstream residents in the event of high water or an emergency condition should be developed and implemented.

3. A program of annual technical inspection should be established.

APPENDIX A

Visual Inspection Check List

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT ST. ALBANS RESERVOIR DAM (NORTH)

DATE August 3, 1978

TIME 10:30

WEATHER Thunder showers

W.S. ELEV. _____ U.S. ____ DN.S.
Within 1' of full

PARTY:

1.	W. A. Henry	D-H	6.
2.	J. R. Spencer	D-H	7.
3.	E. J. Slavin	D-H	8.
4.	G. Castro	GEI	9.
5.			10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT ST. ALBANS RESERVOIR DAM (NORTH) DATE August 3, 1978

PROJECT FEATURE _____ NAME G. Castro

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None apparent.
Pavement Condition	No pavement.
Movement or Settlement of Crest	None apparent.
Lateral Movement	None apparent.
Vertical Alignment	Surfaces too irregular to judge.
Horizontal Alignment	Surfaces too irregular to judge
Condition at Abutment and at Concrete Structures	Good.
Indications of Movement of Structural Items on Slopes	None apparent.
Trespassing on Slopes	None observed.
Sloughing or Erosion of Slopes or Abutments	None observed.
Rock Slope Protection - Riprap Failures	Riprap in good condition where observable.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	Seep area about 25 feet long at toe and lower 8 feet of downstream slope.
Piping or Boils	None observed except minor piping in seep area.
Foundation Drainage Features	None apparent.
Toe Drains	None apparent.
Instrumentation System	None known.
Vegetation	Heavy tree and bush growth on crest, downstream slope and upper part of upstream slope.

PERIODIC INSPECTION CHECK LIST

PROJECT ST. ALBANS RESERVOIR DAM (NORTH) **DATE** August 3, 1978

PROJECT FEATURE Intake **NAME** J. R. Spencer

DISCIPLINE _____ **NAME** _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel Slope Conditions Bottom Conditions Rock Slides or Falls Log Boom Debris Condition of Concrete Lining Drains or Weep Holes	Intake consists of coarse screens which appeared to be in good condition, set in the concrete wall of the gate-house below water level.
b. Intake Structure Condition of Concrete Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT ST. ALBANS RESERVOIR DAM (NORTH) **DATE** August 3, 1978

PROJECT FEATURE Intake House **NAME** J. R. Spencer

DISCIPLINE _____ **NAME** _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Concrete and brick structure, fair condition.
General Condition	
Condition of Joints	N/A
Spalling	Minor.
Visible Reinforcing	No.
Rusting or Staining of Concrete	Minor.
Any Seepage or Efflorescence	No.
Joint Alignment	N/A
Unusual Seepage or Leaks in Gate Chamber	None observed.
Cracks	Minor, in concrete foundation.
Rusting or Corrosion of Steel	N/A
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	N/A
Service Gates	Gate not in operable condition; it is open.
Emergency Gates	
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT ST. ALBANS RESERVOIR DAM (NORTH) **DATE** August 3, 1978

PROJECT FEATURE Spillway Channel **NAME** J. R. Spencer

DISCIPLINE _____ **NAME** _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	SPILLWAY CHANNEL
General Condition of Concrete	Good.
Rust or Staining	No.
Spalling	Yes, minor.
Erosion or Cavitation	One hole where erosion may be a problem.
Visible Reinforcing	
Any Seepage or Efflorescence	No.
Condition at Joints	Some heaving, but for the most part patched.
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	Yes, on both sides.
Condition of Discharge Channel	Good.

PERIODIC INSPECTION CHECK LIST

PROJECT ST. ALBANS RESERVOIR DAM (NORTH) **DATE** August 3, 1978

PROJECT FEATURE _____ **NAME** G. Castro

DISCIPLINE _____ **NAME** _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	N/A
General Condition	N/A
Loose Rock Overhanging Channel	N/A
Trees Overhanging Channel	N/A
Floor of Approach Channel	N/A
b. Weir and Training or Sidewalls	Good condition.
General Condition of Concrete	Fair to good.
Rust or Staining	No.
Spalling	Yes, minor.
Any Visible Reinforcing	No.
Any Seepage or Efflorescence	No.
Drain Holes	N/A
c. Discharge Channel	
General Condition	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	Several, particularly at spillway entrance.
Floor of Channel	Paved, good condition.
Other Obstructions	None observed.

APPENDIX B

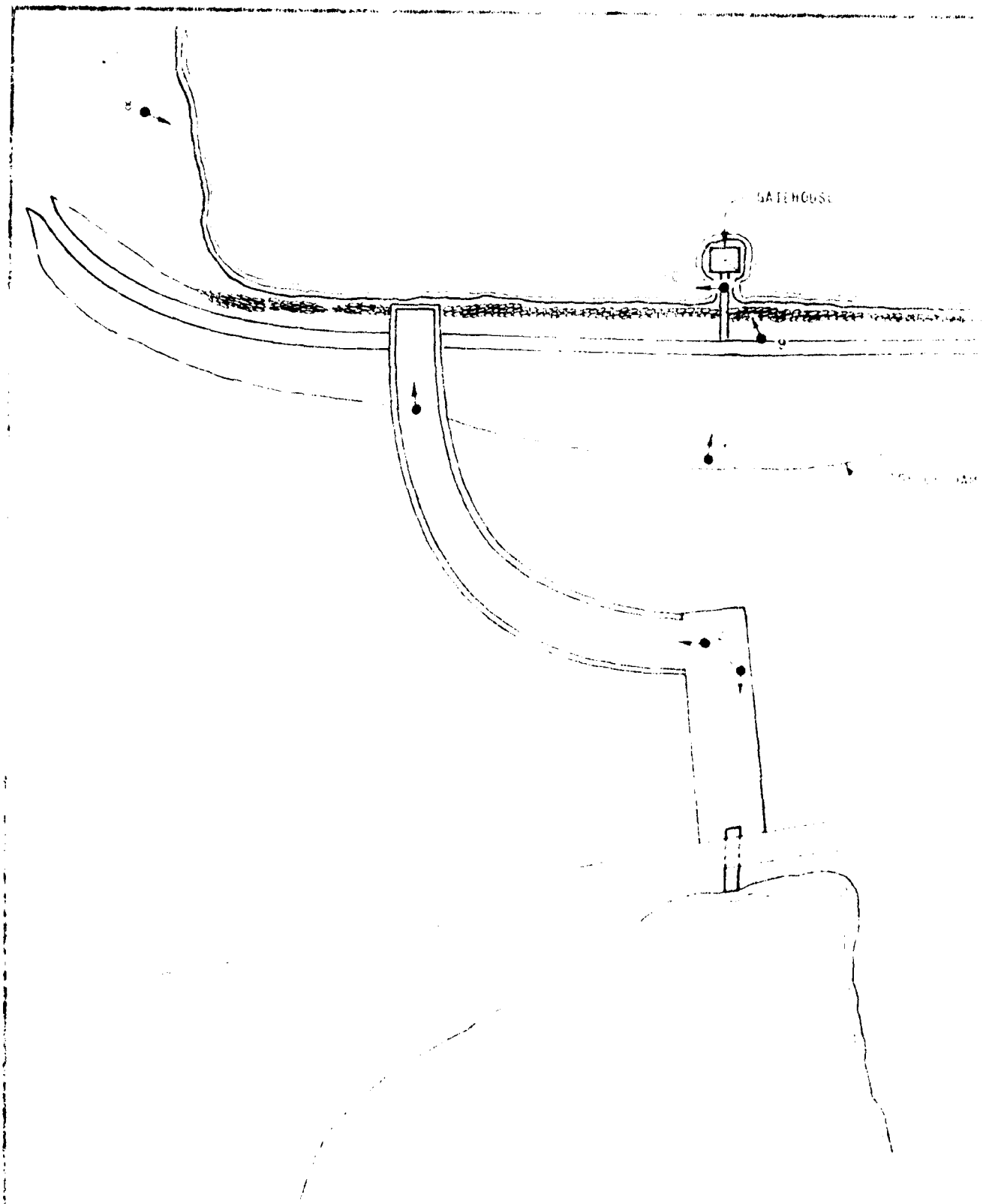
Project Records and Plans

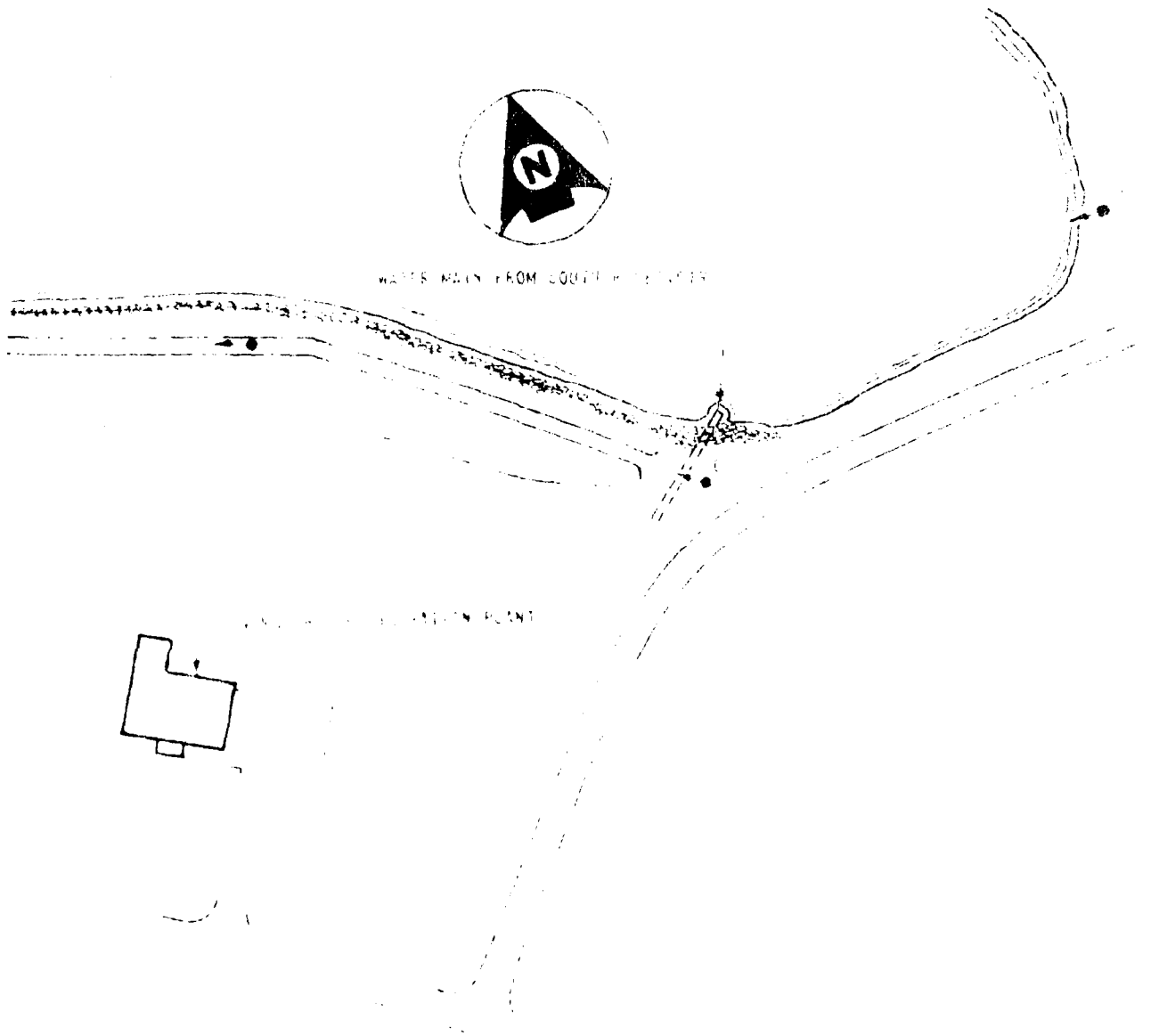
1. A topographic survey of the dam was performed on 11/12/74 by the Vermont Department of Water Resources, and is available at their Montpelier Office.

2. Plans of the St. Albans Water Treatment Plant done in June 1969 are available from Whitman & Howard, Inc., 89 Broad Street, Boston, Massachusetts. These plans show the existing piping which is appurtenant to the dam.

APPENDIX C

PHOTOGRAPHS


GATEHOUSE


N

#1 SPILLWAY INLET.

#2 BOTTOM OF SPILLWAY.

1	3	10	0.02	0.00	0.
1	3	20	0.02	0.00	0.
1	3	30	0.02	0.00	0.
1	3	40	0.02	0.00	0.
1	3	50	0.02	0.00	0.
1	3	60	0.02	0.00	0.
1	4	10	0.02	0.00	0.
1	4	20	0.02	0.00	0.
1	4	30	0.02	0.00	0.
1	4	40	0.02	0.00	0.
1	4	50	0.02	0.00	0.
1	4	60	0.02	0.00	0.
1	5	10	0.02	0.00	0.
1	5	20	0.02	0.00	0.
1	5	30	0.02	0.00	0.
1	5	40	0.02	0.00	0.
1	5	50	0.02	0.00	0.
1	5	60	0.02	0.00	0.
1	6	10	0.05	0.03	1.
1	6	20	0.05	0.03	4.
1	6	30	0.05	0.03	11.
1	6	40	0.05	0.03	22.
1	6	50	0.05	0.03	37.
1	6	60	0.05	0.03	55.
1	7	10	0.05	0.03	75.
1	7	20	0.05	0.03	96.
1	7	30	0.05	0.03	116.
1	7	40	0.05	0.03	134.
1	7	50	0.05	0.03	150.
1	7	60	0.05	0.03	163.
1	8	10	0.05	0.03	174.
1	8	20	0.05	0.03	183.
1	8	30	0.05	0.03	191.
1	8	40	0.05	0.03	198.
1	8	50	0.05	0.03	204.
1	8	60	0.05	0.03	209.
1	9	10	0.05	0.03	213.
1	9	20	0.05	0.03	216.
1	9	30	0.05	0.03	219.
1	9	40	0.05	0.03	222.
1	9	50	0.05	0.03	224.
1	9	60	0.05	0.03	226.
1	10	10	0.05	0.03	227.
1	10	20	0.05	0.03	229.
1	10	30	0.05	0.03	230.
1	10	40	0.05	0.03	231.
1	10	50	0.05	0.03	232.
1	10	60	0.05	0.03	232.
1	11	10	0.05	0.03	233.
1	11	20	0.05	0.03	233.
1	11	30	0.05	0.03	234.
1	11	40	0.05	0.03	234.
1	11	50	0.05	0.03	234.
1	11	60	0.05	0.03	235.
1	12	10	0.30	0.28	242.
1	12	20	0.30	0.28	267.
1	12	30	0.30	0.28	317.

SPILLWAY DESIGN FLOOD
SAINT ALBANS DAM SOUTH
PHASE I DAM SAFETY INVESTIGATION

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
144	0	10	1	0	0	0	2	0	0

JOPER	NWT
3	0

SUB-AREA RUNOFF COMPUTATION

PROBABLE MAXIMUM 24-HOUR PRECIPITATION (NORTH RE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.63	0.0	1.63	1.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	10.00	111.00	123.00	133.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.3	1.00	0.3	0.0	1.00	0.34	0.12	0.0	0.0

UNIT HYDROGRAPH DATA
TP= 1.30 CP=0.68 NTA= 0

RECESSION DATA
STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

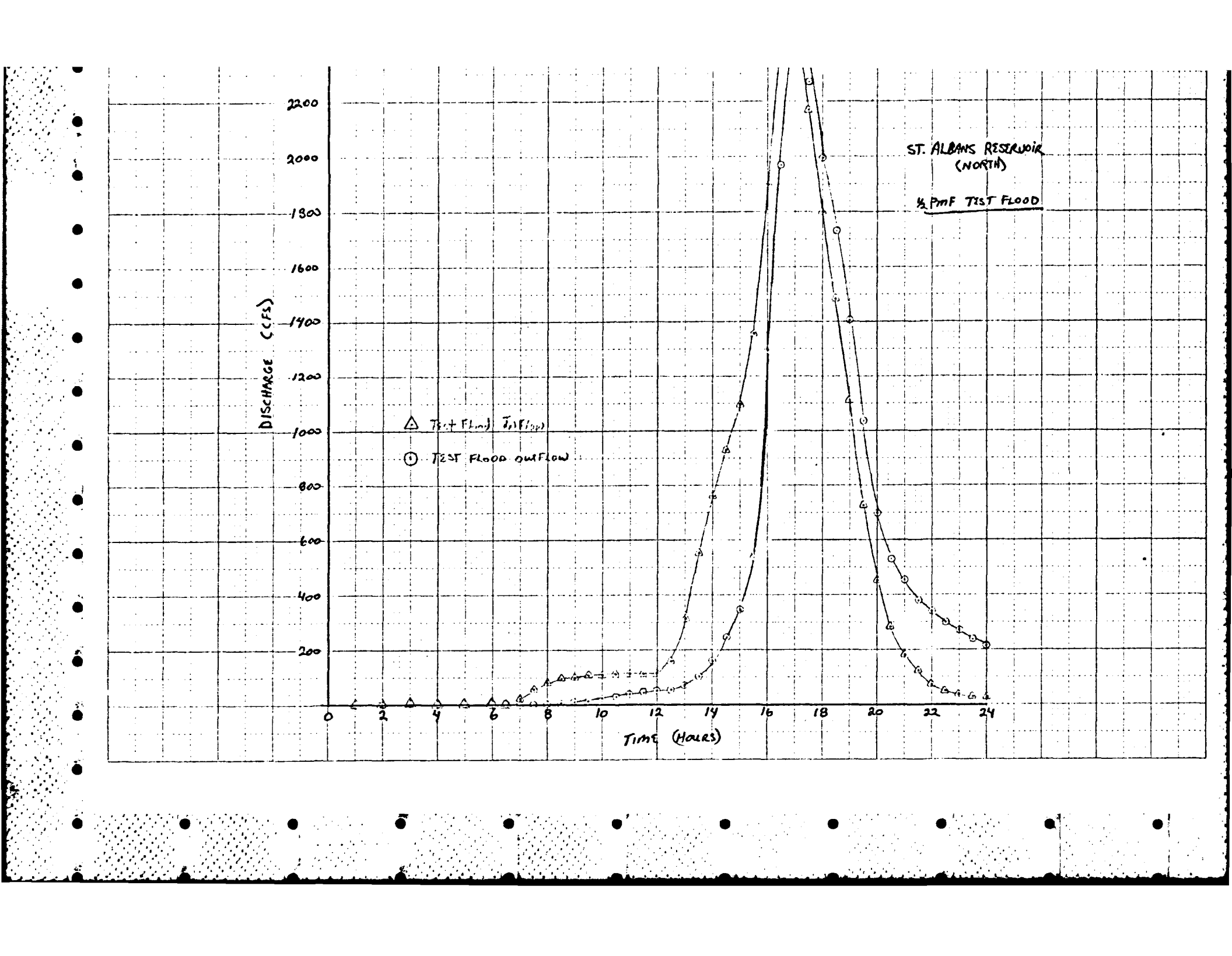
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.96 AND R= 6.11 INTERVALS

UNIT HYDROGRAPH 35 END-OF-PERIOD ORDINATES, LAG= 1.30 HOURS, CP= 0.68 VOL= 1.00

28.	104.	237.	321.	439.	536.	602.	628.	611.	545.
463.	393.	333.	283.	240.	204.	173.	147.	125.	106.
90.	76.	65.	55.	47.	39.	34.	28.	24.	20.
17.	15.	13.	11.	9.	8.	6.	6.		

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	0 10	0.02	0.00	0.
1	0 20	0.02	0.00	0.
1	0 30	0.02	0.00	0.
1	0 40	0.02	0.00	0.
1	0 50	0.02	0.00	0.
1	1 0	0.02	0.00	0.
1	1 10	0.02	0.00	0.
1	1 20	0.02	0.00	0.
1	1 30	0.02	0.00	0.


ST. ALBANS RESERVOIR
(NORTH)
½ PMF TEST FLOOD
DISCHARGE (CFS)
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
TEST FLOOD OUTFLOW
0
2
4
6
8
10
12
14
16
18
20
22
24
TIME (HOURS)

DUFRESNE-HENRY ENGINEERING CORPORATION

J SUBJECT Storage - Discharge Relations SHEET NO. 4 OF 4

St Albans Reservoir (North) JOB NO. 22-0556

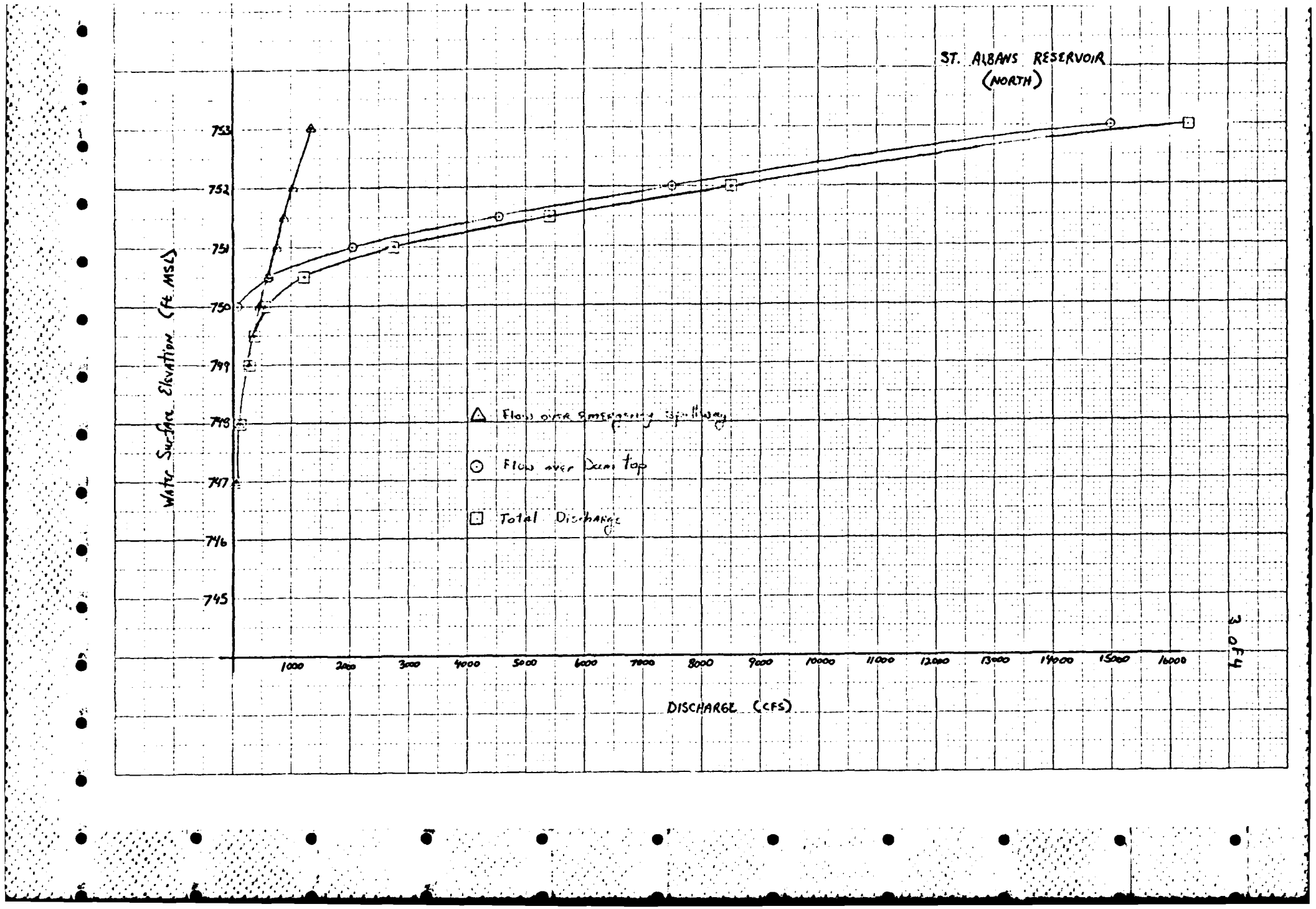
- Discharge Rating Curve for St. Albans Reservoir (North)

Surface Area at Normal Pool (Elev. 745) = 35 Acres
Storage at Normal Pool (Elev. 745) = 850 Acre Feet

Surface Area at Elev. 760 = 51 Acres
Storage at Elev. 760 = 1615 Acre Feet

Δ Storage is assumed to be an average of 26.5 Acre Feet additional storage per 0.5 feet of increase in water surface elevation.

Water Face Elev. (ft, msl)	Storage Ac Ft	Discharge cfs
15	850	0
16.75	943	0
17	956	10
18	1009	120
19	1062	285
19.5	1089	385
50	1115	565
51	1168	2105
52	1221	6850
53	1274	13735


ST. ALBANS RESERVOIR
(NORTH)
Water Surface Elevation (Ft. MSL)
753
752
751
750
749
748
747
746
745
Flow over emergency spillway
Flow over Dam top
Total Discharge
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
16000
DISCHARGE (CFS)
3 of 4

DUFRESNE-HENRY ENGINEERING CORPORATION

SUBJECT Rating Curve for Flow over the Dam
St. Albans Reservoir - North

SHEET NO. 2 OF 4

JOB NO. 22-0556

Flow over the dam is treated as flow over a broad-crested weir. Breadth of weir = 20 feet. C values taken from Table 5-3 of King & Brater's Handbook of Hydraulics assuming 15 foot top width.

$$Q = CA H_{(MAX)}^{1/2}$$

Surface Elevation (Ft)	Area A (Sq. Ft)	Length L (Ft)	$H_{(MAX)}$ (Ft)	C	Discharge Q (CFS)
	44	125	0.5	2.7	85
	230	490	1.0	2.63	605
	627	963	1.5	2.635	2025
	1219	1193	2.0	2.63	4535
	1804	1198	2.5	2.63	7500
	3047	1288	3.5	2.63	15000

Combined Dam Flow & spillway flow

Low face Elevation (Ft)	Spillway Discharge (CFS)	Discharge over Dam (CFS)	Total Discharge (CFS)
746.75	0	0	0
747	10	0	10
748	120	0	120
749	285	0	285
749.5	385	0	385
750	495	85	580
750.5	615	605	1220
751	740	2025	2765
751.5	875	4535	5410
752	1015	7500	8515
753	1320	15000	16320

DUFRESNE-HENRY ENGINEERING CORPORATION

BY [illegible] SUBJECT Spillway Rating Curve SHEET NO. 1 OF 4

St. Albans [illegible] (cont'd) JOB NO. 22-0556

The spillway weir can be considered to be a triangular weir, 27 feet in length, with a 5 to 1 downstream face. The best approximation for a value of C was taken from King & Brater Handbook of Hydraulics, Table 5-7 for heads greater than 0.7 feet and Table 5-6 for heads up to 0.7 feet.

$$Q = CLH^{3/2}$$

Water Surface Elevation (ft)	Weir Length L (ft)	C	Head H (ft)	Discharge Q (cfs)
746.75	—	—	0	—
747.0	27	3.08	0.25	10
748	27	3.13	1.25	120
749	27	3.13	2.25	285
749.5	27	3.13	2.75	385
750	27	3.13	3.25	495
751	27	3.13	4.25	740
752	27	3.13	5.25	1015
753	27	3.13	6.25	1320
754	27	3.13	7.25	1650
755	27	3.13	8.25	2000

* Elevation 749.5 is minimum elevation of dam.

DUFRESNE-HENRY ENGINEERING CORPORATION

SUBJECT Hydrologic Data
St. Albans Reservoir North

SHEET NO. 1 OF 1
JOB NO. 22-0556

Albans Reservoir North

Drainage Area: 1.83 sq. mi.
Pond Surface Area: 35 acres at elevation 746, 51 acres at elevation 760

Soils: Lyman, Marlow, Peru: Type C

Dam size: Small
Hazard class: High
Test Flood: ½ PMF

Soil Retention Rate = 0.12 in/hr (Design of Small Dams pg 64)

$$t_p = 2.2 \left(\frac{L \cdot L_c}{\sqrt{s}} \right)^{0.37}$$

L = hydraulic length

L_c = centroid of stream @ (0.6 L)

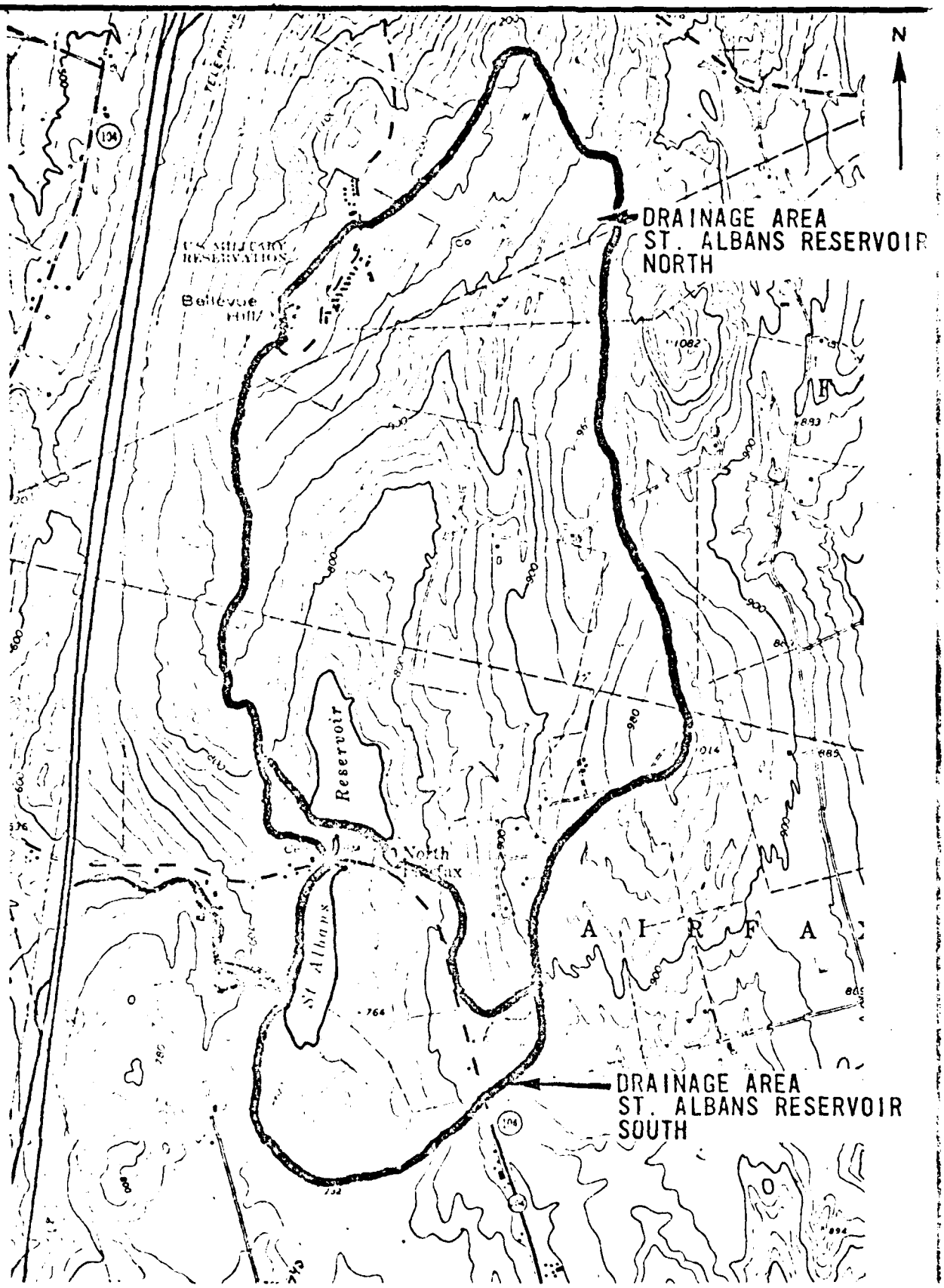
s = Avg. slope (ft/mi)

$$t_p = 2.2 \left(\frac{2.4 \times 1.44}{\sqrt{208.3}} \right)^{0.37}$$

$t_p = 1.3$ hours

$t_r = \frac{t_p}{5.5} = 0.24$ hours = 14 minutes

Note: For HEC-1 use 10 minute intervals over 24 hours.



DRAWING NO	22-0556	DUFRESNE-HENRY ENGINEERING CORP.
PROJ ENG	JRS	DRAINAGE AREA
DRAWN BY	RB	ST. ALBANS RESERVOIR NORTH & SOUTH
DATE	9-14-78	A 6034

APPENDIX D

Hydraulic Computations

#9 WATER INTAKE STRUCTURE AND GATEHOUSE.

#10 UPSTREAM SLOPE FROM INTAKE STRUCTURE TO SPILLWAY.

#7 UPSTREAM SLOPE BY LEFT ABUTMENT SHOWING ALSO DISCHARGE FROM SOUTH RESERVOIR PUMPING STATION.

#8 UPSTREAM FACE SHOWING ALSO INTAKE STRUCTURE AND GATEHOUSE.

#5 DAM CREST NEAR CENTER LOOKING WEST.

#6 DAM CREST NEAR LEFT ABUTMENT LOOKING WEST.

#3 CONCRETE CHANNEL AND CULVERT UNDER HIGHWAY LEADING TO SOUTH RESERVOIR.

#4 ACTIVE SEEP ON DOWNSTREAM SLOPE OF DAM.

1	12	50	0.30	0.28	502.
1	12	60	0.30	0.28	632.
1	13	10	0.36	0.34	780.
1	13	20	0.36	0.34	939.
1	13	30	0.36	0.34	1099.
1	13	40	0.36	0.34	1251.
1	13	50	0.36	0.34	1389.
1	13	60	0.36	0.34	1516.
1	14	10	0.44	0.42	1635.
1	14	20	0.44	0.42	1750.
1	14	30	0.44	0.42	1863.
1	14	40	0.44	0.42	1973.
1	14	50	0.44	0.42	2082.
1	14	60	0.44	0.42	2188.
1	15	10	1.12	1.10	2311.
1	15	20	1.12	1.10	2480.
1	15	30	1.12	1.10	2711.
1	15	40	1.12	1.10	3006.
1	15	50	1.12	1.10	3374.
1	15	60	1.12	1.10	3798.
1	16	10	0.41	0.39	4236.
1	16	20	0.41	0.39	4631.
1	16	30	0.41	0.39	4935.
1	16	40	0.41	0.39	5107.
1	16	50	0.41	0.39	5135.
1	16	60	0.41	0.39	5041.
1	17	10	0.33	0.31	4856.
1	17	20	0.33	0.31	4608.
1	17	30	0.33	0.31	4332.
1	17	40	0.33	0.31	4066.
1	17	50	0.33	0.31	3825.
1	17	60	0.33	0.31	3607.
1	18	10	0.03	0.01	3399.
1	18	20	0.03	0.01	3189.
1	18	30	0.03	0.01	2968.
1	18	40	0.03	0.01	2733.
1	18	50	0.03	0.01	2485.
1	18	60	0.03	0.01	2224.
1	19	10	0.03	0.01	1960.
1	19	20	0.03	0.01	1700.
1	19	30	0.03	0.01	1457.
1	19	40	0.03	0.01	1242.
1	19	50	0.03	0.01	1059.
1	19	60	0.03	0.01	905.
1	20	10	0.03	0.01	773.
1	20	20	0.03	0.01	662.
1	20	30	0.03	0.01	567.
1	20	40	0.03	0.01	486.
1	20	50	0.03	0.01	418.
1	20	60	0.03	0.01	360.
1	21	10	0.03	0.01	310.
1	21	20	0.03	0.01	269.
1	21	30	0.03	0.01	230.
1	21	40	0.03	0.01	197.
1	21	50	0.03	0.01	169.
1	21	60	0.03	0.01	146.
1	22	10	0.03	0.01	126.
1	22	20	0.03	0.01	109.
1	22	30	0.03	0.01	97.
1	22	40	0.03	0.01	88.
1	22	50	0.03	0.01	80.
1	22	60	0.03	0.01	73.
1	23	10	0.03	0.01	67.
1	23	20	0.03	0.01	62.
1	23	30	0.03	0.01	57.

1	23	50	0.03	0.01	53.
1	23	60	0.03	0.01	51.
		SUM	21.36	18.48	129837.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5135.	3051.	902.	902.	129834.
INCHES		15.51	18.33	18.33	18.33
AC-FT		1513.	1789.	1789.	1789.

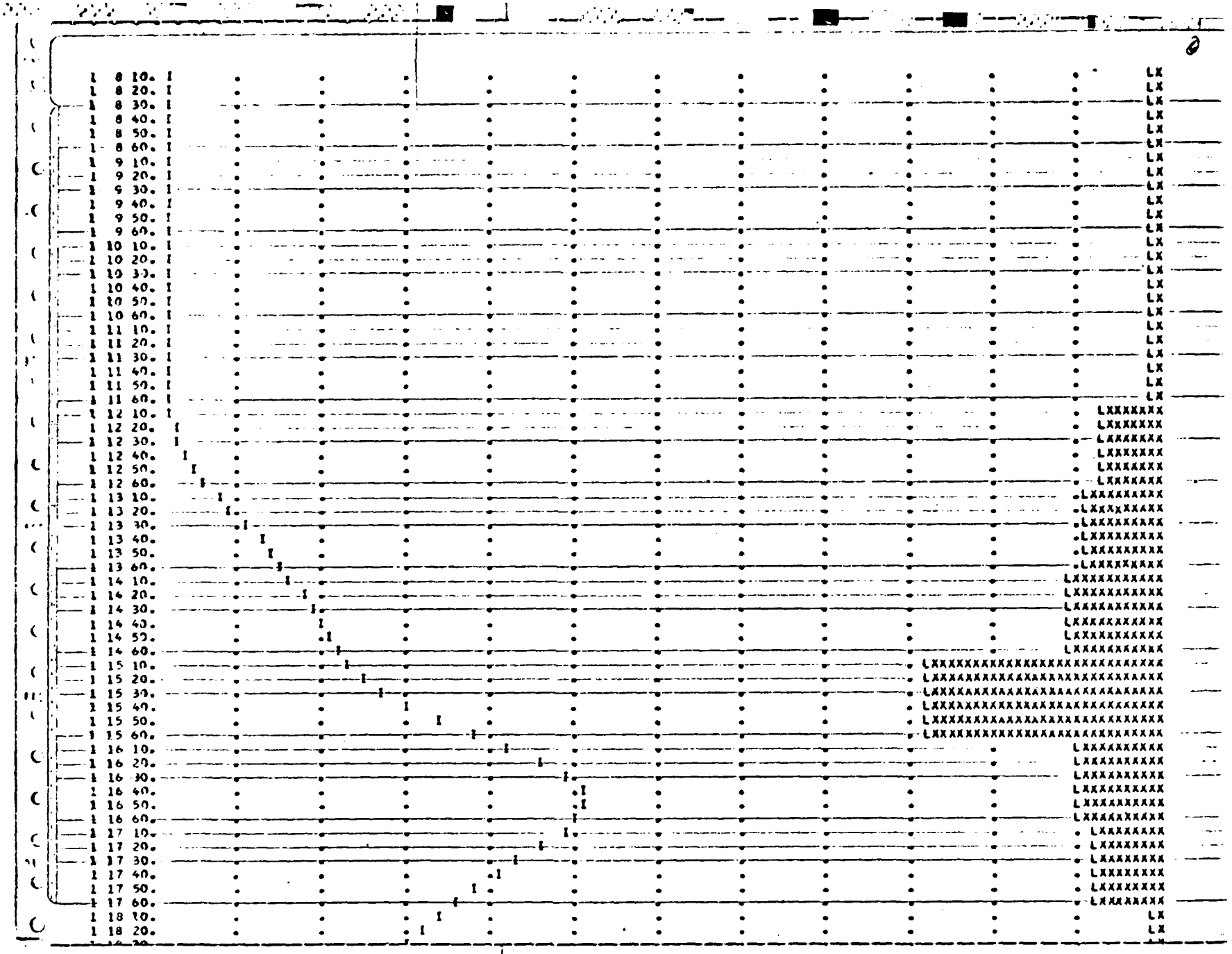
④

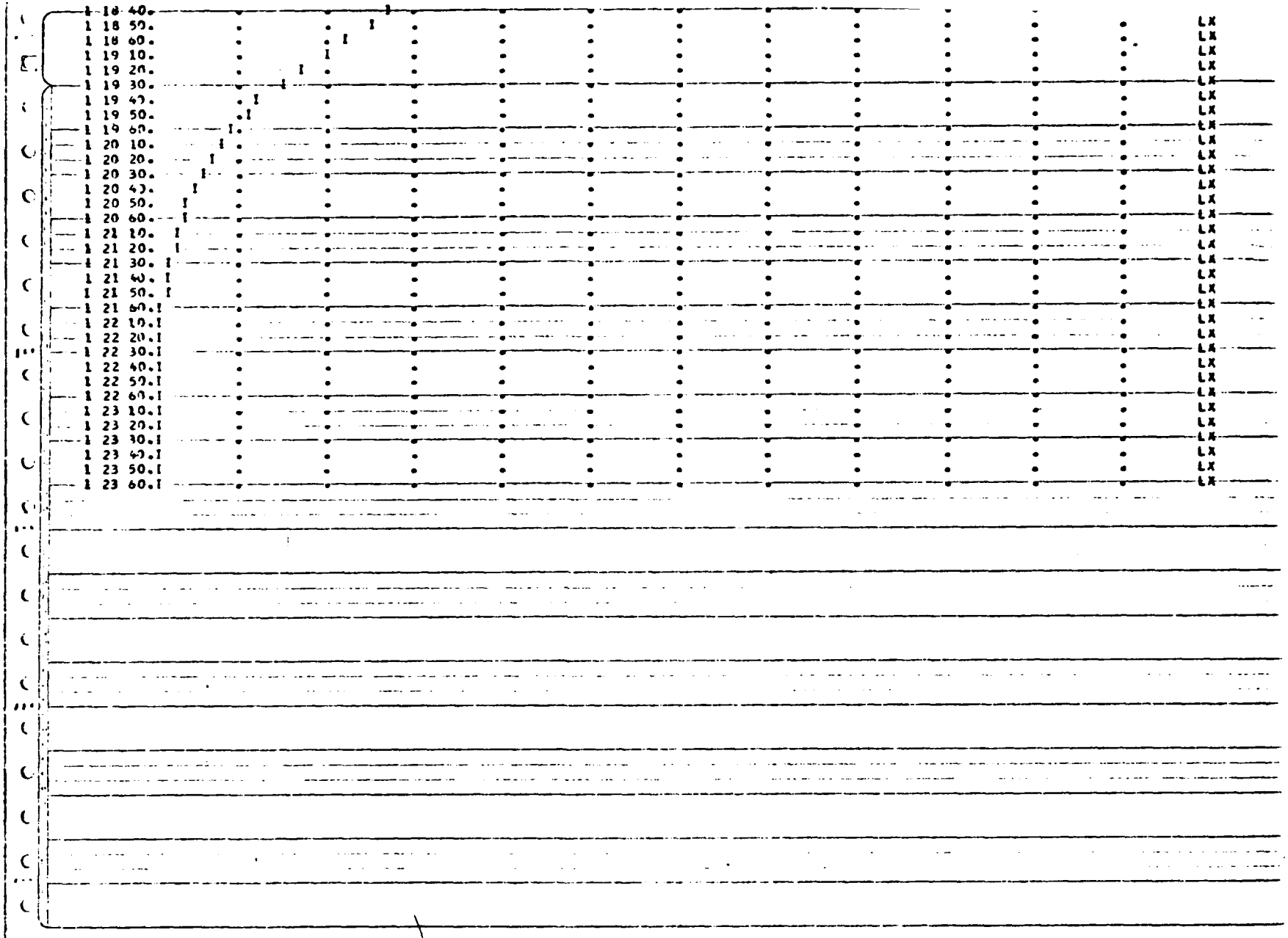
OVF

STATION 1

INFLOW*I<, OUTFLOW*O< AND OBSERVED FLOW*#*<

	0.	1000.	2000.	3000.	4000.	5000.	6000.	0.	0.	0.	0.	0.	0.
										PRECIP&L< AND EXCESS*X<			
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.8	0.4	0.0
1 0 10I													L
1 0 20I													L
1 0 30I													L
1 0 40I													L
1 0 50I													L
1 0 60I													L
1 1 10I													L
1 1 20I													L
1 1 30I													L
1 1 40I													L
1 1 50I													L
1 1 60I													L
1 2 10I													L
1 2 20I													L
1 2 30I													L
1 2 40I													L
1 2 50I													L
1 2 60I													L
1 3 10I													L
1 3 20I													L
1 3 30I													L
1 3 40I													L
1 3 50I													L
1 3 60I													L
1 4 10I													L
1 4 20I													L
1 4 30I													L
1 4 40I													L
1 4 50I													L
1 4 60I													L
1 5 10I													L
1 5 20I													L
1 5 30I													L
1 5 40I													L
1 5 50I													L
1 5 60I													L
1 6 10I													LX
1 6 20I													LX
1 6 30I													LX
1 6 40I													LX
1 6 50I													LX
1 6 60.I													LX
1 7 10.I													LX
1 7 20.I													LX
1 7 30.I													LX
1 7 40.I													LX
1 7 50.I													LX
1 7 60. I													LX


1 8 10.
1 8 20.
1 8 30.
1 8 40.
1 8 50.
1 8 60.
1 9 10.
1 9 20.
1 9 30.
1 9 40.
1 9 50.
1 9 60.
1 10 10.
1 10 20.
1 10 30.
1 10 40.
1 10 50.
1 10 60.
1 11 10.
1 11 20.
1 11 30.
1 11 40.
1 11 50.
1 11 60.
1 12 10.
1 12 20.
1 12 30.
1 12 40.
1 12 50.
1 12 60.
1 13 10.
1 13 20.
1 13 30.
1 13 40.
1 13 50.
1 13 60.
1 14 10.
1 14 20.
1 14 30.
1 14 40.
1 14 50.
1 14 60.
1 15 10.
1 15 20.
1 15 30.
1 15 40.
1 15 50.
1 15 60.
1 16 10.
1 16 20.
1 16 30.
1 16 40.
1 16 50.
1 16 60.
1 17 10.
1 17 20.
1 17 30.
1 17 40.
1 17 50.
1 17 60.
1 18 10.
1 18 20.


1 18 40.
1 18 50.
1 18 60.
1 19 10.
1 19 20.
1 19 30.
1 19 40.
1 19 50.
1 19 60.
1 20 10.
1 20 20.
1 20 30.
1 20 40.
1 20 50.
1 20 60.
1 21 10.
1 21 20.
1 21 30.
1 21 40.
1 21 50.
1 21 60.
1 22 10.
1 22 20.
1 22 30.
1 22 40.
1 22 50.
1 22 60.
1 23 10.
1 23 20.
1 23 30.
1 23 40.
1 23 50.
1 23 60.

CVN

RUNOFF MULTIPLIED BY 0.50

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	2.	6.	11.
18.	27.	37.	48.	58.	67.	75.	81.	87.	92.
96.	99.	102.	104.	106.	108.	110.	111.	112.	113.
114.	114.	115.	115.	116.	116.	116.	117.	117.	117.
117.	117.	121.	134.	159.	198.	251.	316.	390.	469.
550.	625.	694.	758.	818.	875.	931.	987.	1041.	1094.
1155.	1240.	1355.	1504.	1687.	1899.	2118.	2315.	2467.	2554.
2568.	2521.	2426.	2304.	2166.	2033.	1913.	1803.	1700.	1595.
1484.	1367.	1242.	1112.	980.	850.	728.	621.	530.	452.
387.	331.	283.	243.	209.	180.	155.	134.	115.	99.
85.	73.	63.	54.	49.	44.	40.	37.	34.	31.
29.	28.	26.	25.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2568.	1525.	451.	451.	64918.
INCHES		7.75	9.17	9.17	9.17
AC-FT		757.	895.	895.	895.

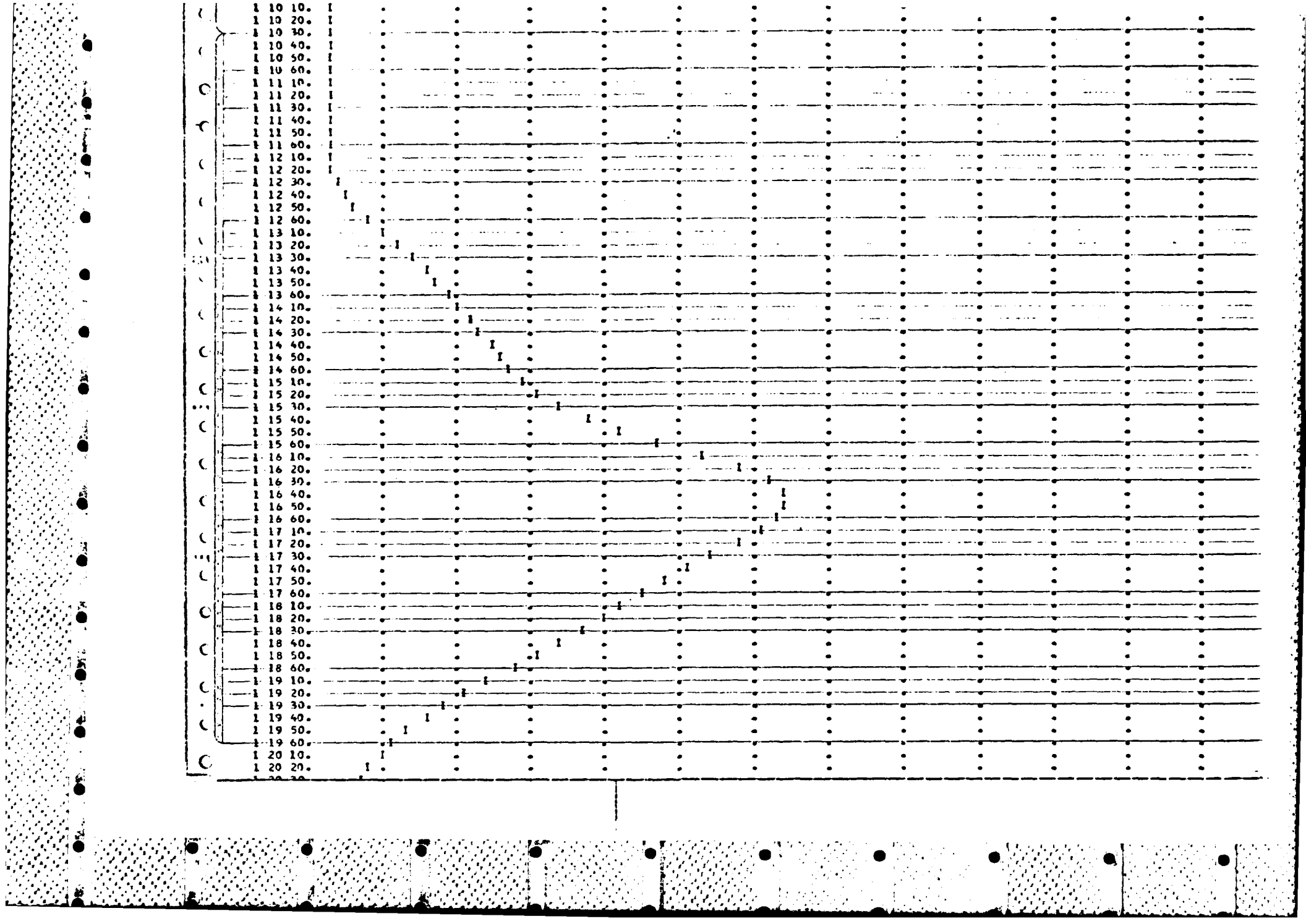
OVF

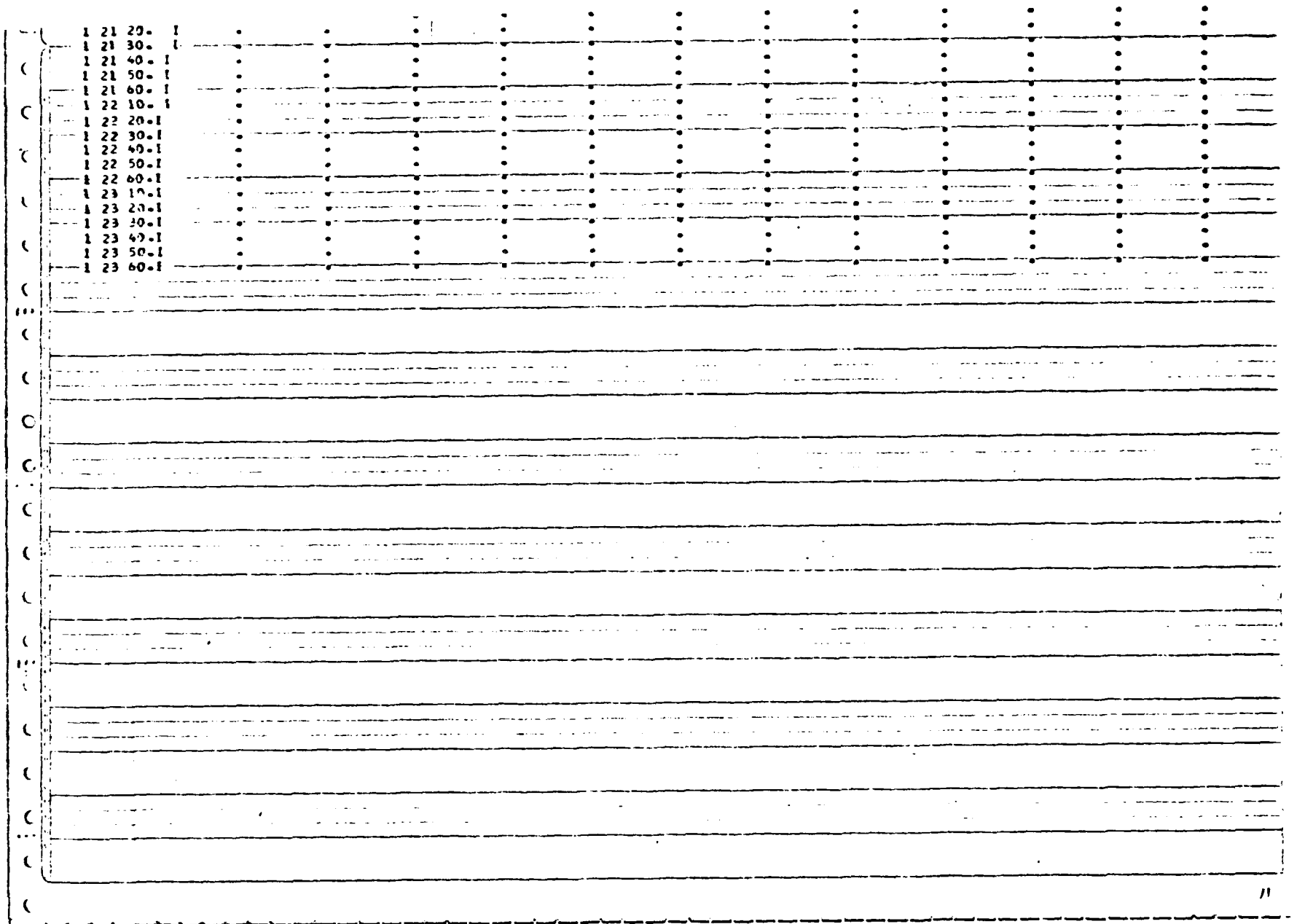
STATION 1

INFLOW=I<, OUTFLOW=O< AND OBSERVED FLOW=*<

0. 400. 800. 1200. 1600. 2000. 2400. 2800. 0. 0. 0. 0. 0. 0.

1 0 10I
1 0 20I
1 0 30I
1 0 40I
1 0 50I
1 0 60I
1 1 10I
1 1 20I
1 1 30I
1 1 40I
1 1 50I
1 1 60I
1 2 10I
1 2 20I
1 2 30I
1 2 40I
1 2 50I
1 2 60I
1 3 10I
1 3 20I
1 3 30I
1 3 40I
1 3 50I
1 3 60I
1 4 10I
1 4 20I
1 4 30I
1 4 40I
1 4 50I
1 4 60I
1 5 10I
1 5 20I
1 5 30I
1 5 40I
1 5 50I
1 5 60I
1 6 10I
1 6 20I
1 6 30I
1 6 40I
1 6 50I
1 6 60.I
1 7 10.I
1 7 20.I
1 7 30.I
1 7 40. I
1 7 50. I
1 7 60. I
1 8 10. I
1 8 20. I
1 8 30. I
1 8 40. I
1 8 50. I
1 8 60. I
1 9 10. I
1 9 20. I


1 10 10.
1 10 20.
1 10 30.
1 10 40.
1 10 50.
1 10 60.
1 11 10.
1 11 20.
1 11 30.
1 11 40.
1 11 50.
1 11 60.
1 12 10.
1 12 20.
1 12 30.
1 12 40.
1 12 50.
1 12 60.
1 13 10.
1 13 20.
1 13 30.
1 13 40.
1 13 50.
1 13 60.
1 14 10.
1 14 20.
1 14 30.
1 14 40.
1 14 50.
1 14 60.
1 15 10.
1 15 20.
1 15 30.
1 15 40.
1 15 50.
1 15 60.
1 16 10.
1 16 20.
1 16 30.
1 16 40.
1 16 50.
1 16 60.
1 17 10.
1 17 20.
1 17 30.
1 17 40.
1 17 50.
1 17 60.
1 18 10.
1 18 20.
1 18 30.
1 18 40.
1 18 50.
1 18 60.
1 19 10.
1 19 20.
1 19 30.
1 19 40.
1 19 50.
1 19 60.
1 20 10.
1 20 20.


1 21 20- I
1 21 30- I
1 21 40- I
1 21 50- I
1 21 60- I
1 22 10- I
1 22 20-I
1 22 30-I
1 22 40-I
1 22 50-I
1 22 60-I
1 23 10-I
1 23 20-I
1 23 30-I
1 23 40-I
1 23 50-I
1 23 60-I

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

PULS RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.0	0.0	0.0	-1.

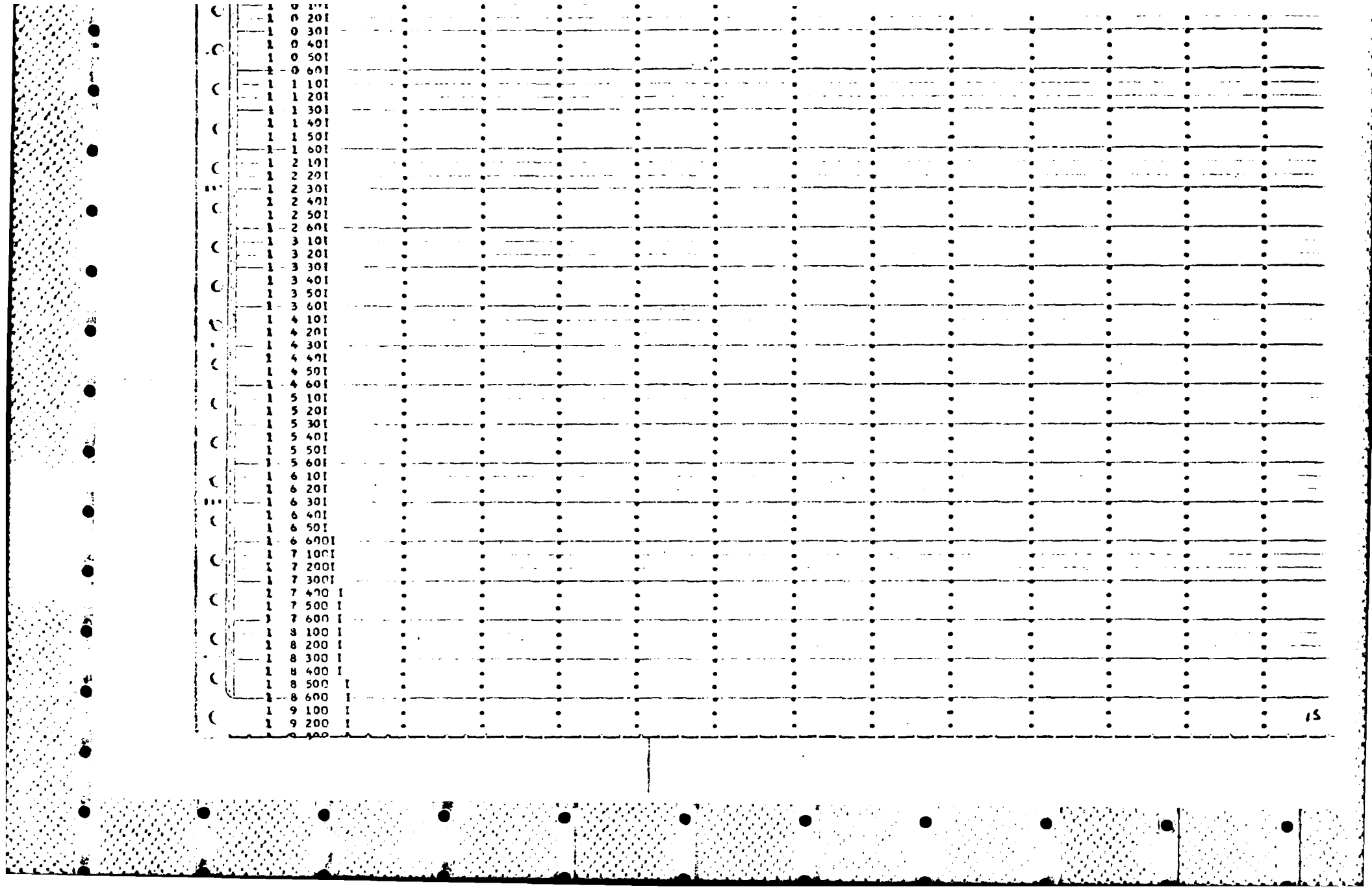
STORAGE#	850.	943.	956.	1009.	1062.	1089.	1115.	1168.	1221.	1274.
OUTFLOW#	0.	0.	10.	120.	285.	385.	565.	2105.	6850.	13735.

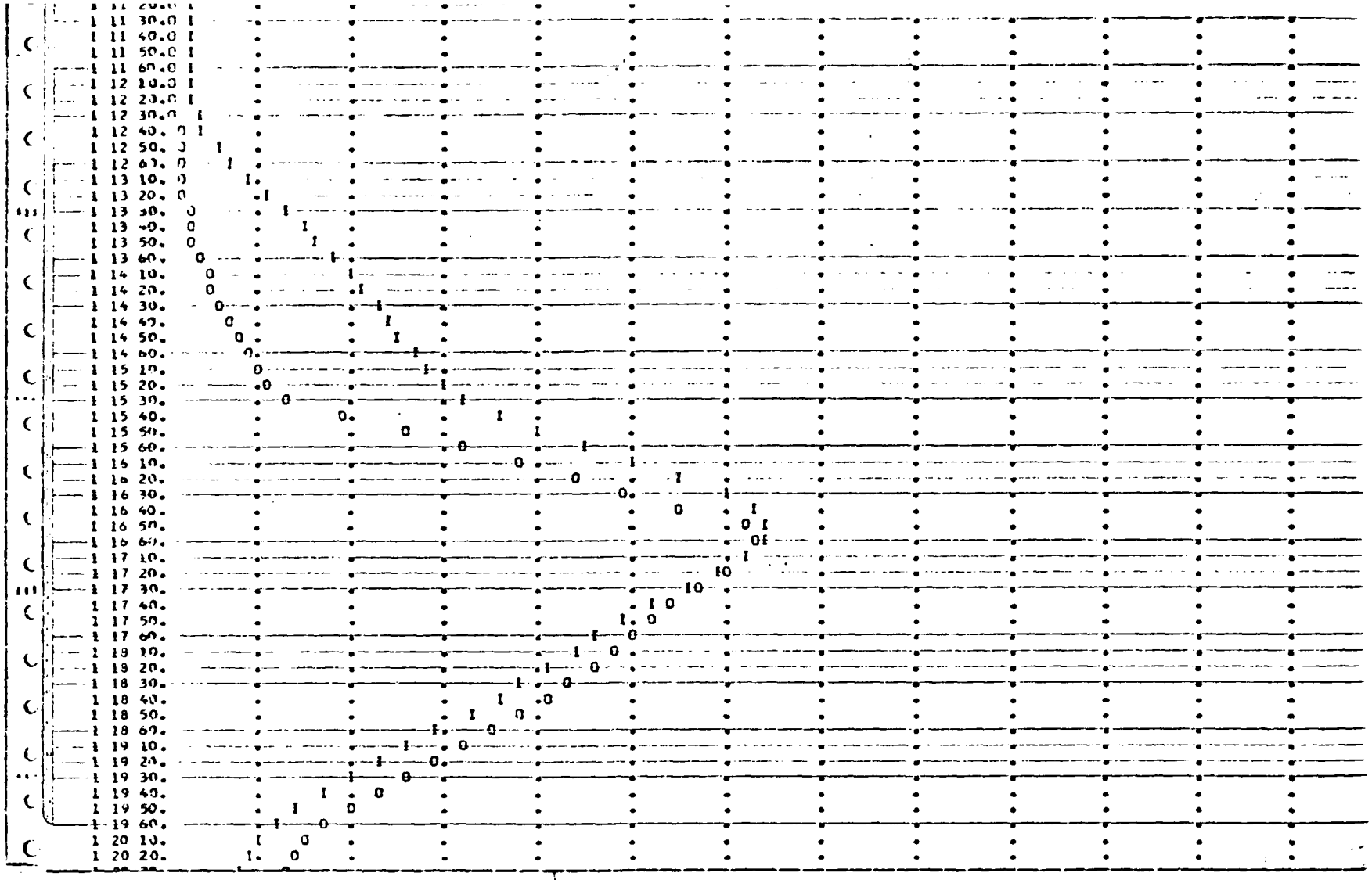
	TIME	EOP STOR	AVG IN	EOP OUT
1	0 10	943.	0.	0.
1	0 20	943.	0.	0.
1	0 30	943.	0.	0.
1	0 40	943.	0.	0.
1	0 50	943.	0.	0.
1	0 60	943.	0.	0.
1	1 10	943.	0.	0.
1	1 20	943.	0.	0.
1	1 30	943.	0.	0.
1	1 40	943.	0.	0.
1	1 50	943.	0.	0.
1	1 60	943.	0.	0.
1	2 10	943.	0.	0.
1	2 20	943.	0.	0.
1	2 30	943.	0.	0.
1	2 40	943.	0.	0.
1	2 50	943.	0.	0.
1	2 60	943.	0.	0.
1	3 10	943.	0.	0.
1	3 20	943.	0.	0.
1	3 30	943.	0.	0.
1	3 40	943.	0.	0.
1	3 50	943.	0.	0.
1	3 60	943.	0.	0.
1	4 10	943.	0.	0.
1	4 20	943.	0.	0.
1	4 30	943.	0.	0.
1	4 40	943.	0.	0.
1	4 50	943.	0.	0.
1	4 60	943.	0.	0.
1	5 10	943.	0.	0.
1	5 20	943.	0.	0.
1	5 30	943.	0.	0.
1	5 40	943.	0.	0.
1	5 50	943.	0.	0.
1	5 60	943.	0.	0.
1	6 10	943.	0.	0.
1	6 20	943.	1.	0.
1	6 30	943.	4.	0.
1	6 40	943.	8.	0.

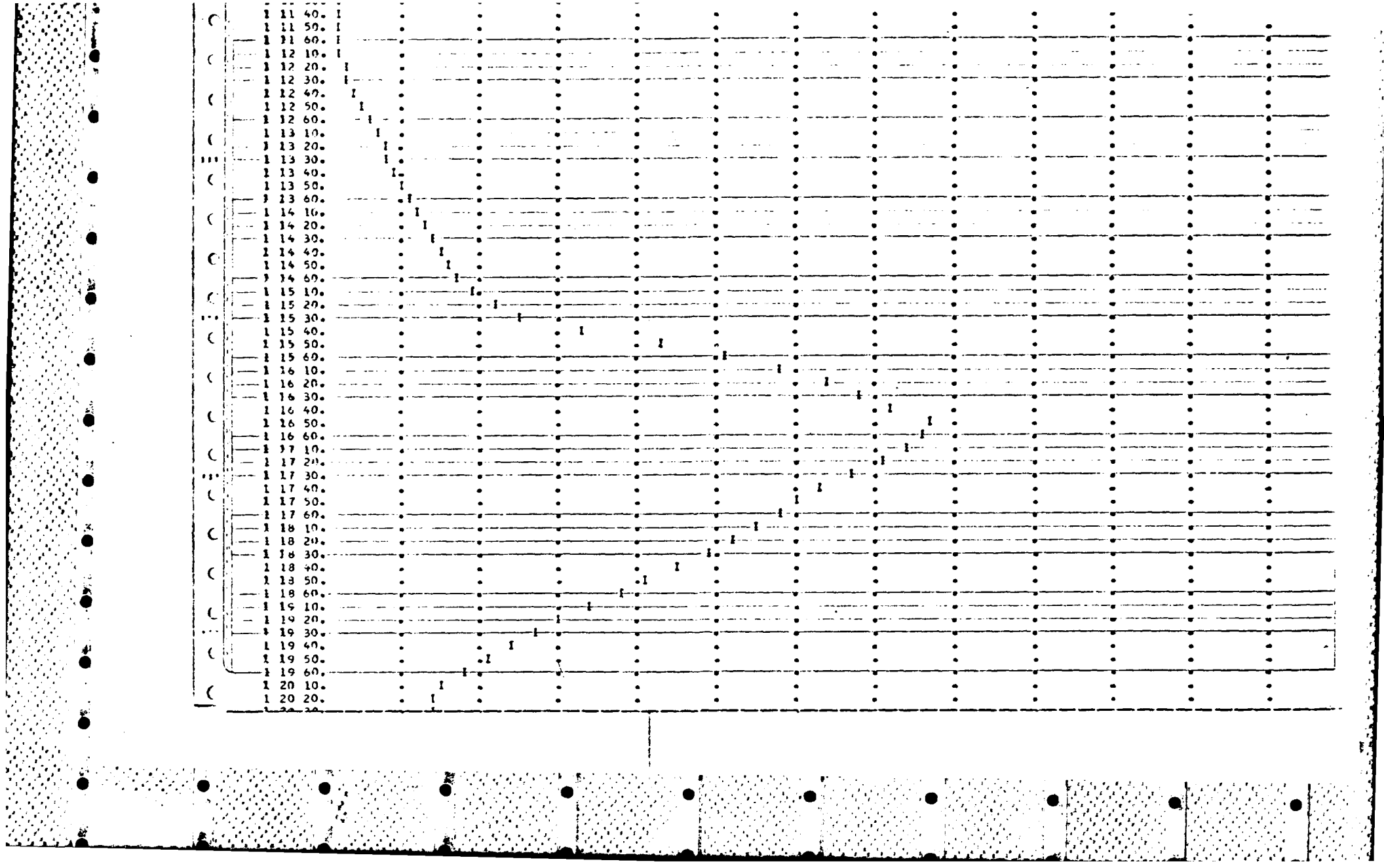
1	8	10	949.	84.	5.
1	8	20	950.	89.	6.
1	8	30	952.	94.	7.
1	8	40	953.	97.	8.
1	8	50	954.	100.	9.
1	8	60	955.	103.	10.
1	9	10	957.	105.	12.
1	9	20	958.	107.	14.
1	9	30	959.	109.	17.
1	9	40	961.	110.	20.
1	9	50	962.	111.	22.
1	9	60	963.	112.	25.
1	10	10	964.	113.	27.
1	10	20	965.	114.	30.
1	10	30	967.	115.	32.
1	10	40	968.	115.	34.
1	10	50	969.	116.	37.
1	10	60	970.	116.	39.
1	11	10	971.	116.	41.
1	11	20	972.	117.	43.
1	11	30	973.	117.	45.
1	11	40	974.	117.	47.
1	11	50	975.	117.	49.
1	11	60	976.	117.	51.
1	12	10	977.	119.	53.
1	12	20	978.	127.	55.
1	12	30	979.	146.	58.
1	12	40	981.	178.	61.
1	12	50	983.	224.	66.
1	12	60	986.	284.	72.
1	13	10	990.	353.	80.
1	13	20	994.	430.	90.
1	13	30	1000.	510.	101.
1	13	40	1007.	588.	115.
1	13	50	1014.	660.	136.
1	13	60	1022.	726.	160.
1	14	10	1030.	788.	187.
1	14	20	1039.	846.	214.
1	14	30	1049.	903.	243.
1	14	40	1058.	959.	273.
1	14	50	1068.	1014.	308.
1	14	60	1078.	1067.	346.
1	15	10	1089.	1125.	385.
1	15	20	1100.	1198.	450.
1	15	30	1111.	1296.	535.
1	15	40	1121.	1430.	753.
1	15	50	1131.	1596.	1034.
1	15	60	1140.	1793.	1287.
1	16	10	1148.	2008.	1528.
1	16	20	1156.	2217.	1757.
1	16	30	1163.	2391.	1969.
1	16	40	1169.	2510.	2207.
1	16	50	1172.	2561.	2477.
1	16	60	1173.	2544.	2528.
1	17	10	1172.	2474.	2487.
1	17	20	1171.	2366.	2395.
1	17	30	1170.	2235.	2273.
1	17	40	1168.	2100.	2141.

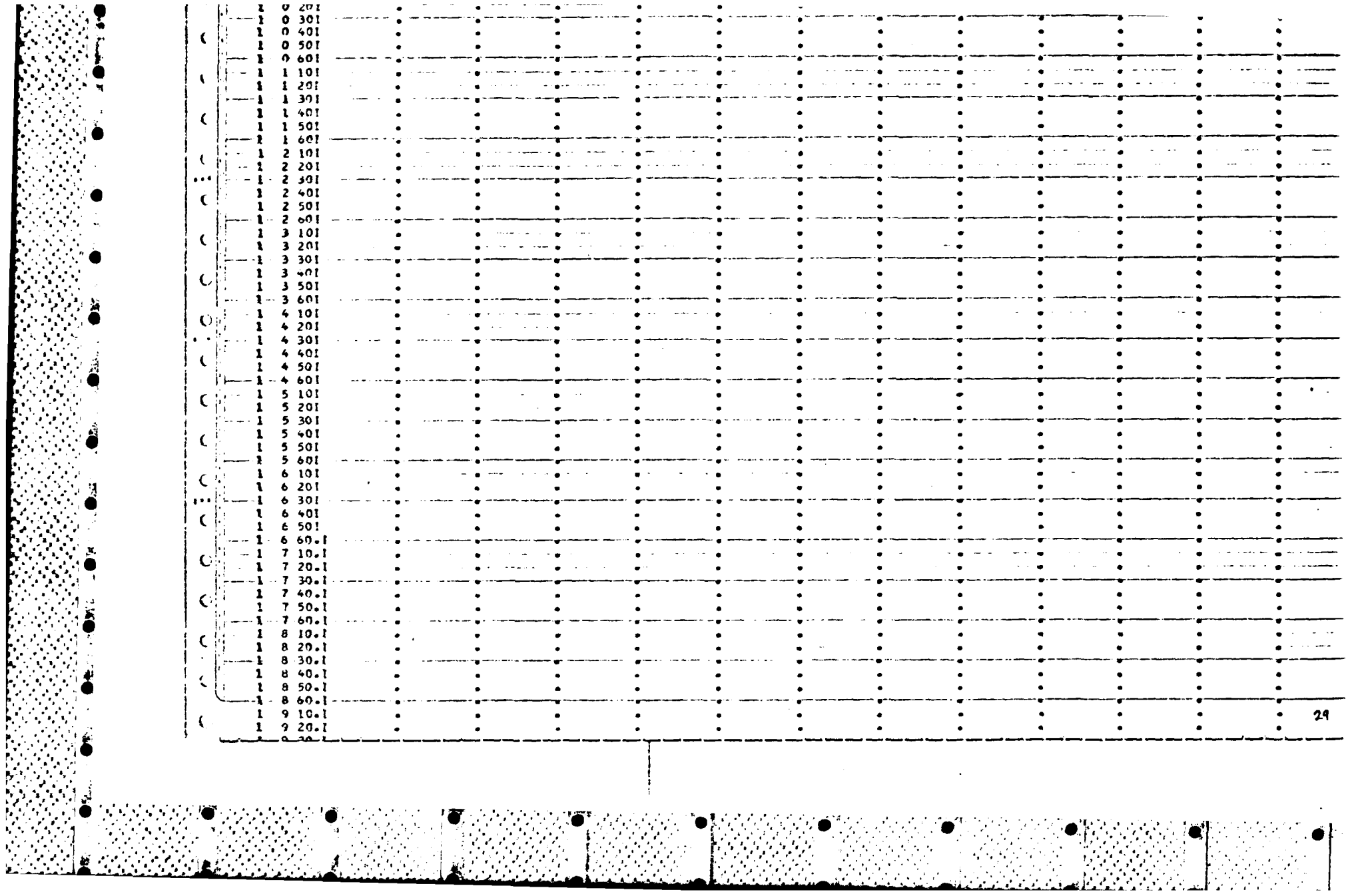
1	19	20	1136.	915.	1162.	
1	19	30	1131.	789.	1036.	
1	19	40	1127.	675.	917.	
1	19	50	1123.	575.	803.	
1	19	60	1120.	491.	699.	
1	20	10	1116.	420.	606.	
1	20	20	1113.	359.	564.	
1	20	30	1110.	307.	531.	
1	20	40	1107.	263.	507.	
1	20	50	1103.	226.	481.	
1	20	60	1099.	194.	455.	
1	21	10	1095.	168.	429.	
1	21	20	1092.	145.	403.	
1	21	30	1088.	125.	381.	
1	21	40	1084.	107.	367.	
1	21	50	1081.	92.	354.	
1	21	60	1077.	79.	340.	
1	22	10	1073.	68.	326.	
1	22	20	1070.	59.	313.	
1	22	30	1066.	52.	300.	
1	22	40	1063.	46.	287.	
1	22	50	1059.	42.	277.	
1	22	60	1056.	38.	267.	
1	23	10	1053.	35.	257.	
1	23	20	1050.	32.	248.	
1	23	30	1047.	30.	238.	
1	23	40	1044.	29.	230.	
1	23	50	1041.	27.	221.	
1	23	60	1039.	26.	213.	
		SUM			58046.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2528.	1372.	403.	403.	58046.
INCHES		6.97	8.20	8.20	8.20
AC-FT		680.	800.	800.	800.


1 0 101
1 0 201
1 0 301
1 0 401
1 0 501
1 0 601
1 1 101
1 1 201
1 1 301
1 1 401
1 1 501
1 1 601
1 2 101
1 2 201
1 2 301
1 2 401
1 2 501
1 2 601
1 3 101
1 3 201
1 3 301
1 3 401
1 3 501
1 3 601
1 4 101
1 4 201
1 4 301
1 4 401
1 4 501
1 4 601
1 5 101
1 5 201
1 5 301
1 5 401
1 5 501
1 5 601
1 6 101
1 6 201
1 6 301
1 6 401
1 6 501
1 6 6001
1 7 1001
1 7 2001
1 7 3001
1 7 400 I
1 7 500 I
1 7 600 I
1 8 100 I
1 8 200 I
1 8 300 I
1 8 400 I
1 8 500 I
1 8 600 I
1 9 100 I
1 9 200 I
15




1 11 40.
1 11 50.
1 11 60.
1 12 10.
1 12 20.
1 12 30.
1 12 40.
1 12 50.
1 12 60.
1 13 10.
1 13 20.
1 13 30.
1 13 40.
1 13 50.
1 13 60.
1 14 10.
1 14 20.
1 14 30.
1 14 40.
1 14 50.
1 14 60.
1 15 10.
1 15 20.
1 15 30.
1 15 40.
1 15 50.
1 15 60.
1 16 10.
1 16 20.
1 16 30.
1 16 40.
1 16 50.
1 16 60.
1 17 10.
1 17 20.
1 17 30.
1 17 40.
1 17 50.
1 17 60.
1 18 10.
1 18 20.
1 18 30.
1 18 40.
1 18 50.
1 18 60.
1 19 10.
1 19 20.
1 19 30.
1 19 40.
1 19 50.
1 19 60.
1 20 10.
1 20 20.


1 0 20I
1 0 30I
1 0 40I
1 0 50I
1 0 60I
1 1 10I
1 1 20I
1 1 30I
1 1 40I
1 1 50I
1 1 60I
1 2 10I
1 2 20I
1 2 30I
1 2 40I
1 2 50I
1 2 60I
1 3 10I
1 3 20I
1 3 30I
1 3 40I
1 3 50I
1 3 60I
1 4 10I
1 4 20I
1 4 30I
1 4 40I
1 4 50I
1 4 60I
1 5 10I
1 5 20I
1 5 30I
1 5 40I
1 5 50I
1 5 60I
1 6 10I
1 6 20I
1 6 30I
1 6 40I
1 6 50I
1 6 60.I
1 7 10.I
1 7 20.I
1 7 30.I
1 7 40.I
1 7 50.I
1 7 60.I
1 8 10.I
1 8 20.I
1 8 30.I
1 8 40.I
1 8 50.I
1 8 60.I
1 9 10.I
1 9 20.I
29

COMBINE HYDROGRAPHS

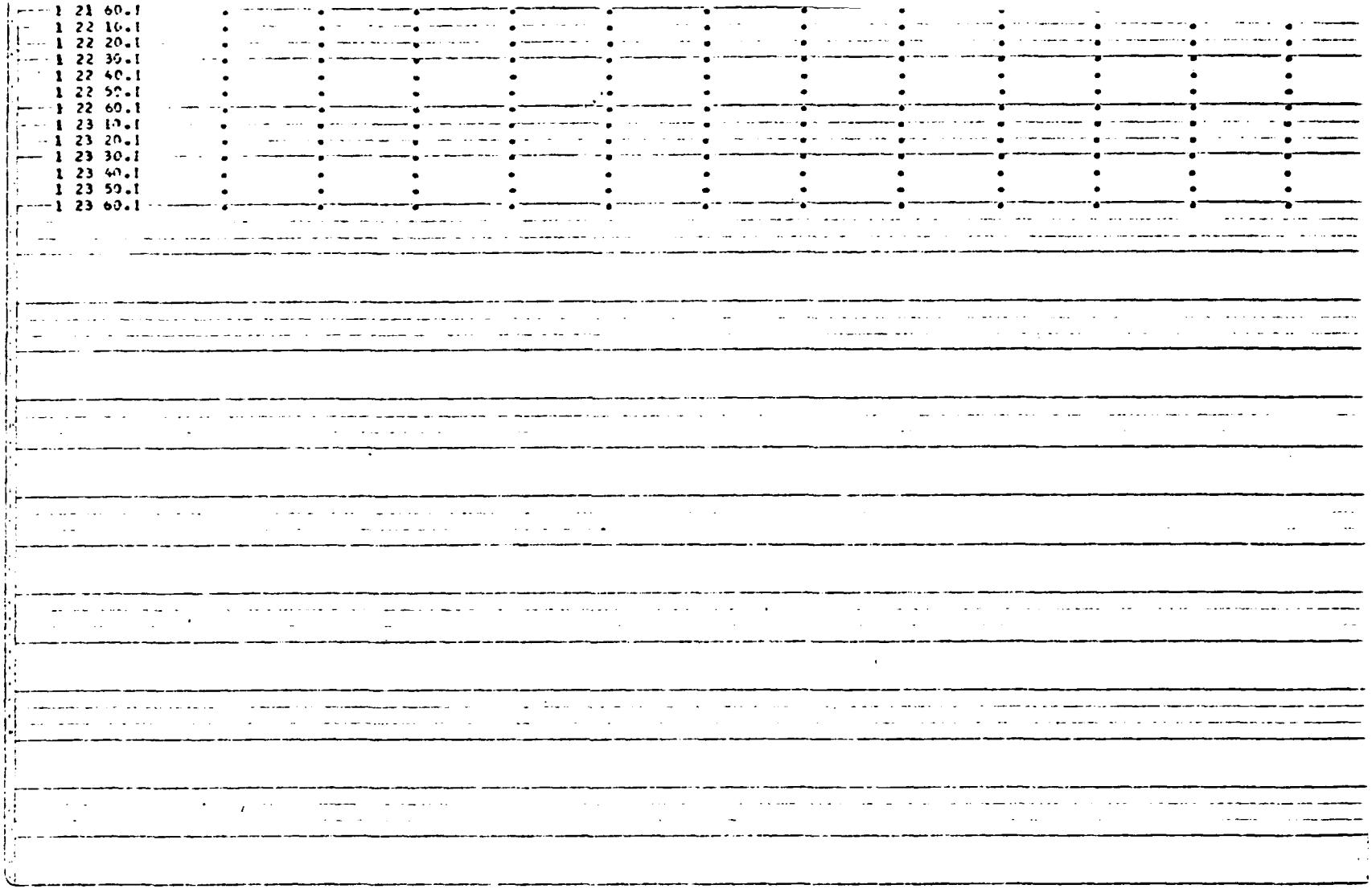
COMBINED NORTH RESERVOIR OUTFLOW AND SOUTH RESERVOI

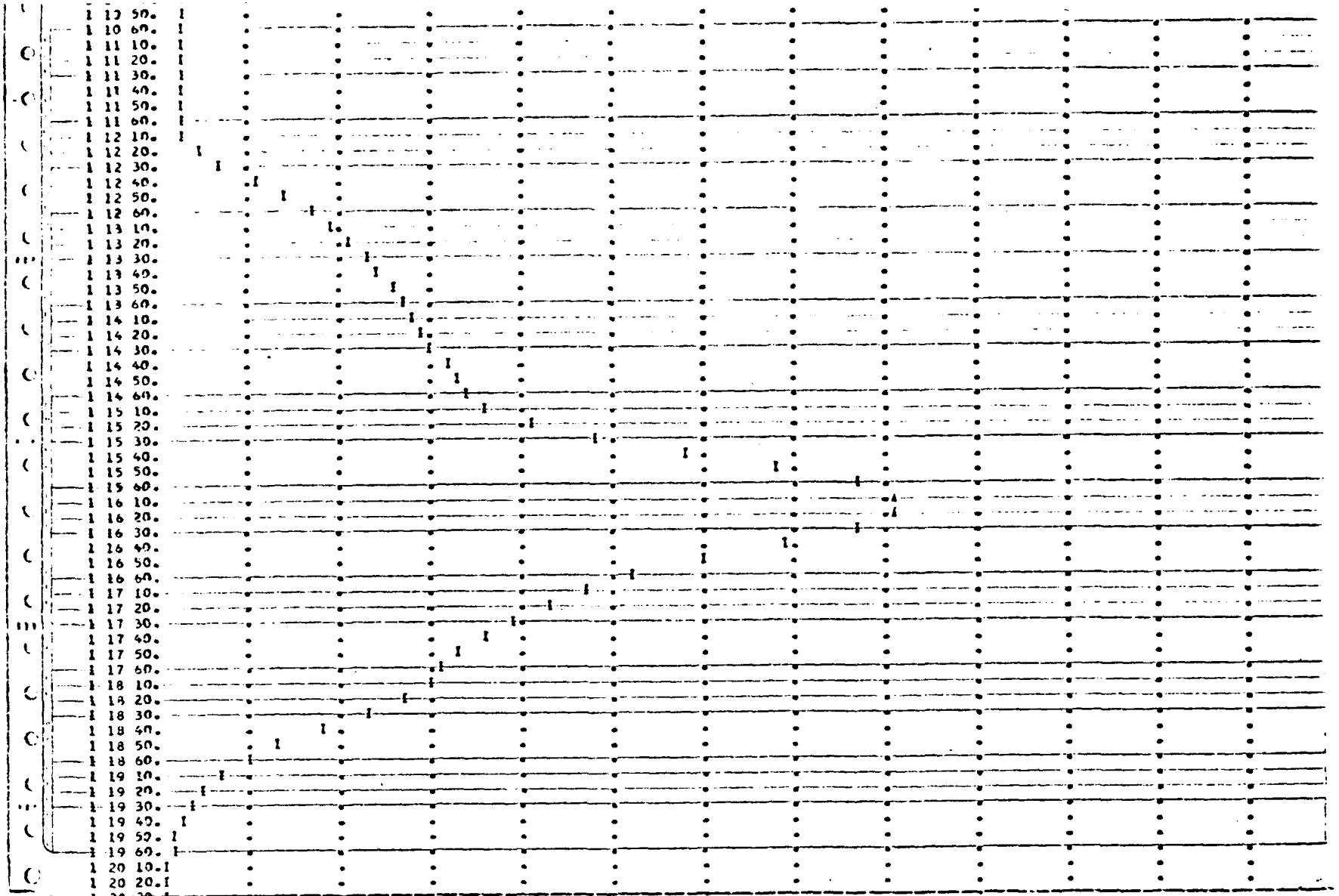
ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
4	2	0	0	0	0	1

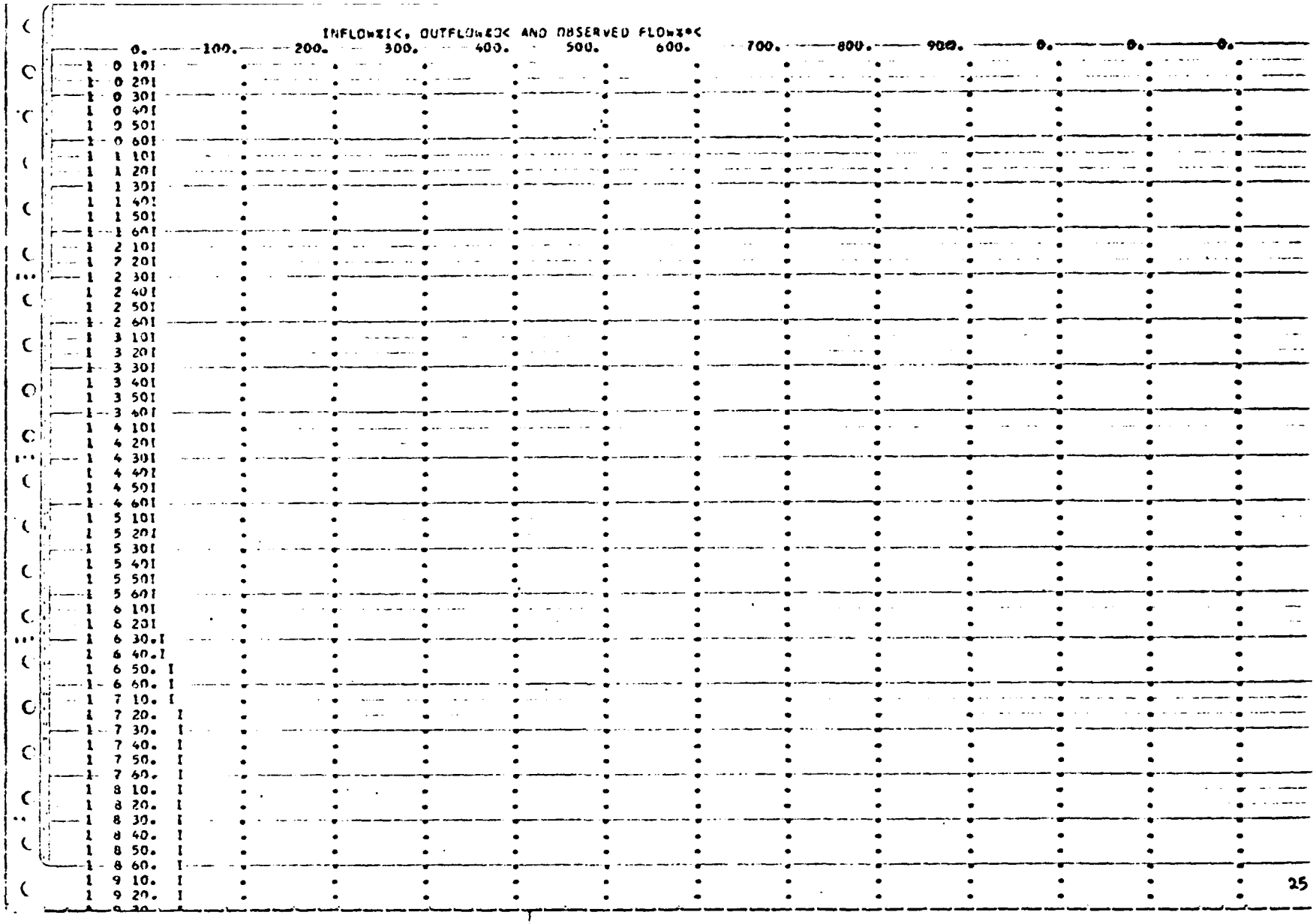
SUM OF 2 HYDROGRAPHS AT 4

0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	4.	8.	12.
17.	22.	25.	27.	29.	31.	32.	34.	35.	36.
37.	38.	39.	40.	42.	45.	48.	50.	53.	55.
58.	60.	63.	65.	67.	69.	72.	74.	76.	78.
80.	82.	88.	104.	132.	170.	210.	245.	274.	301.
330.	359.	393.	429.	464.	502.	544.	589.	639.	688.
746.	865.	1018.	1335.	1717.	2052.	2340.	2569.	2734.	2892.
3073.	3050.	2955.	2821.	2663.	2500.	2348.	2310.	2209.	2093.
1958.	1809.	1654.	1501.	1354.	1212.	1075.	945.	825.	716.
620.	565.	541.	516.	490.	463.	436.	411.	388.	375.
361.	347.	334.	321.	308.	295.	284.	274.	264.	255.
246.	237.	229.	220.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3073.	1695.	516.	516.	74279.
INCHES		0.92	8.42	8.42	8.42
AC-FT		841.	1024.	1024.	1024.


1 21 60.1
1 22 10.1
1 22 20.1
1 22 30.1
1 22 40.1
1 22 50.1
1 22 60.1
1 23 10.1
1 23 20.1
1 23 30.1
1 23 40.1
1 23 50.1
1 23 60.1

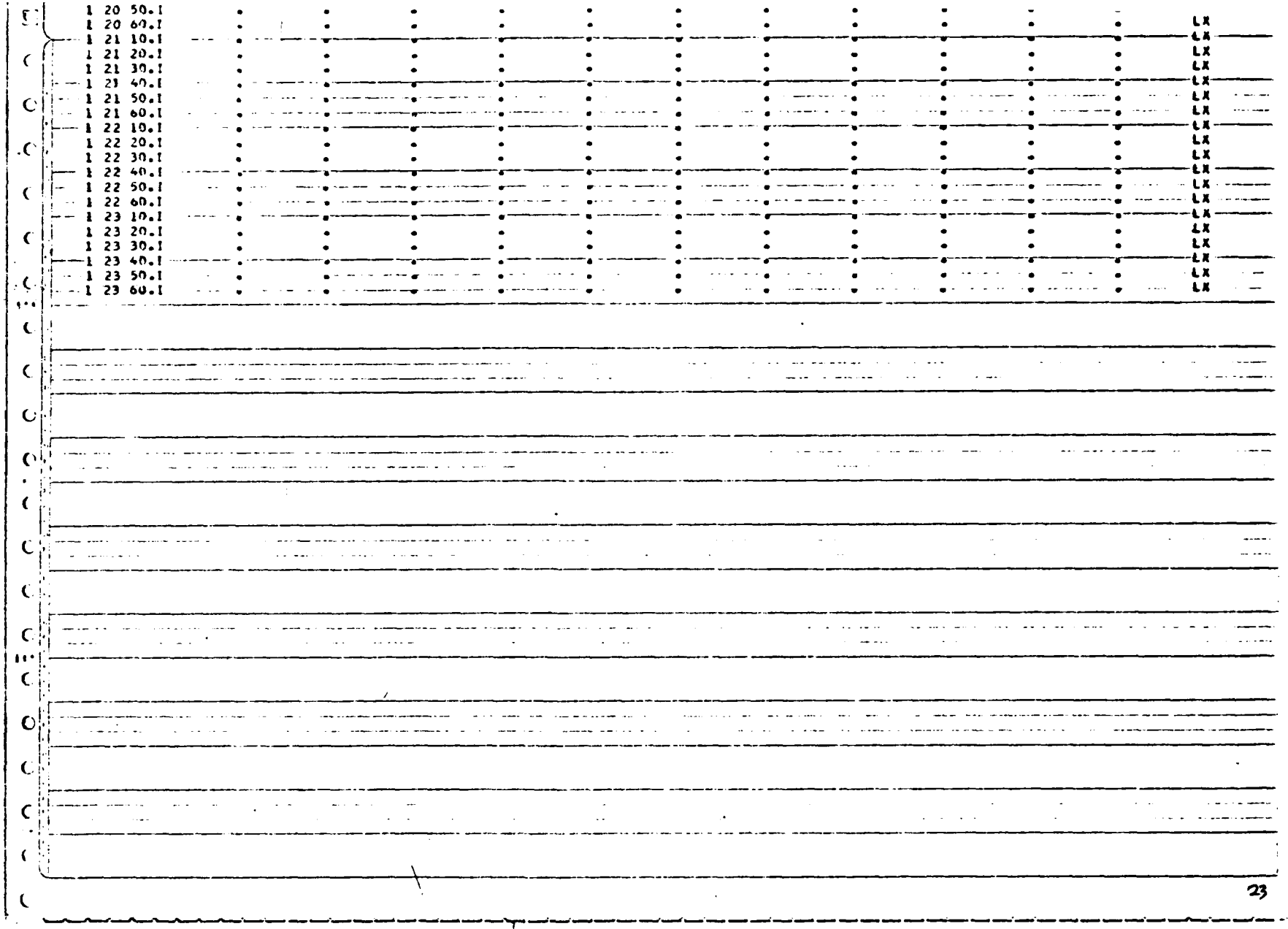

1 19 50.
1 10 60.
1 11 10.
1 11 20.
1 11 30.
1 11 40.
1 11 50.
1 11 60.
1 12 10.
1 12 20.
1 12 30.
1 12 40.
1 12 50.
1 12 60.
1 13 10.
1 13 20.
1 13 30.
1 13 40.
1 13 50.
1 13 60.
1 14 10.
1 14 20.
1 14 30.
1 14 40.
1 14 50.
1 14 60.
1 15 10.
1 15 20.
1 15 30.
1 15 40.
1 15 50.
1 15 60.
1 16 10.
1 16 20.
1 16 30.
1 16 40.
1 16 50.
1 16 60.
1 17 10.
1 17 20.
1 17 30.
1 17 40.
1 17 50.
1 17 60.
1 18 10.
1 18 20.
1 18 30.
1 18 40.
1 18 50.
1 18 60.
1 19 10.
1 19 20.
1 19 30.
1 19 40.
1 19 50.
1 19 60.
1 20 10.
1 20 20.

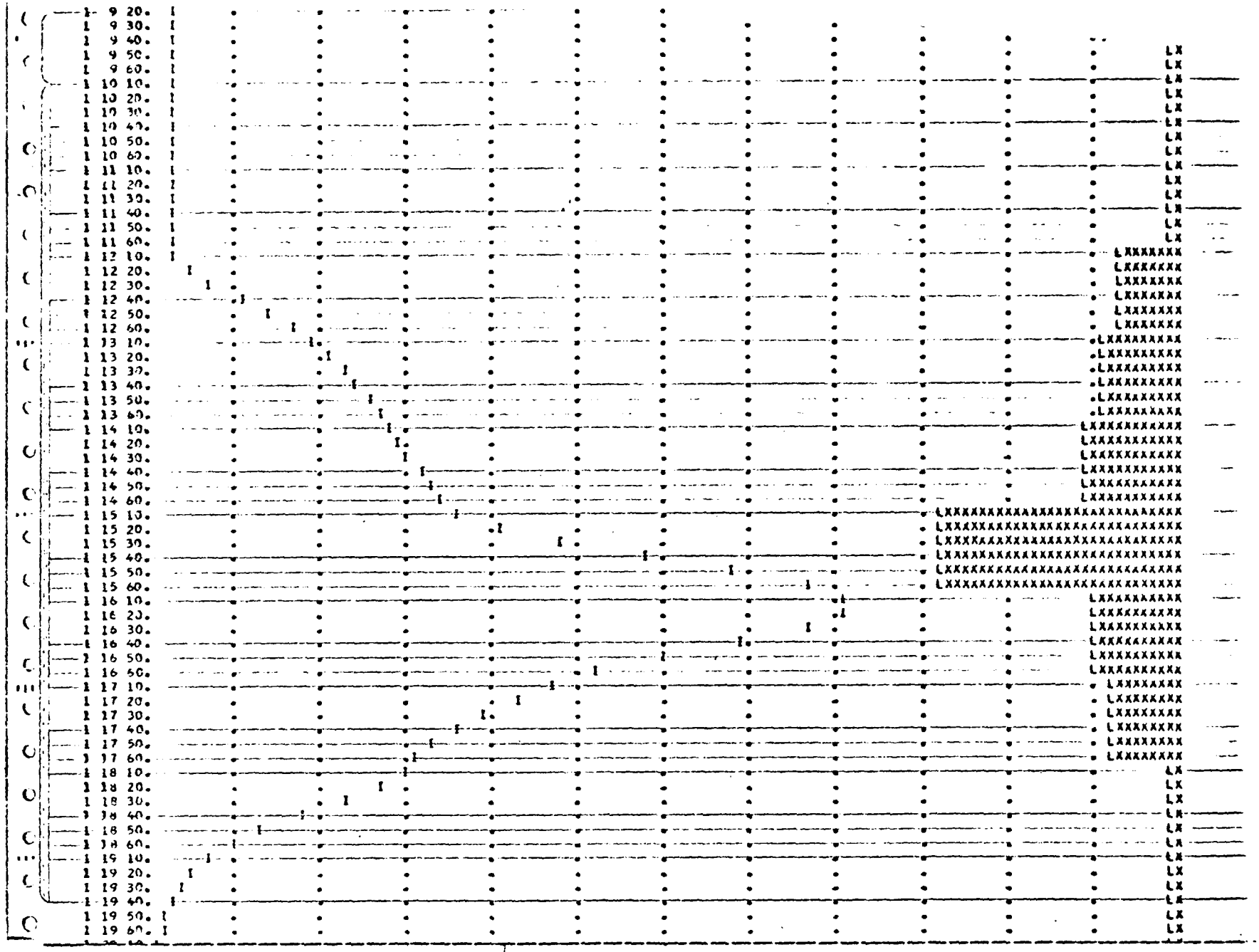

INFLOW*I<, OUTFLOW*3< AND OBSERVED FLOW*P<
0. 100. 200. 300. 400. 500. 600. 700. 800. 900. 0. 0. 0.
1 0 10I
1 0 20I
1 0 30I
1 0 40I
1 0 50I
1 0 60I
1 1 10I
1 1 20I
1 1 30I
1 1 40I
1 1 50I
1 1 60I
1 2 10I
1 2 20I
1 2 30I
1 2 40I
1 2 50I
1 2 60I
1 3 10I
1 3 20I
1 3 30I
1 3 40I
1 3 50I
1 3 60I
1 4 10I
1 4 20I
1 4 30I
1 4 40I
1 4 50I
1 4 60I
1 5 10I
1 5 20I
1 5 30I
1 5 40I
1 5 50I
1 5 60I
1 6 10I
1 6 20I
1 6 30.I
1 6 40.I
1 6 50. I
1 6 60. I
1 7 10. I
1 7 20. I
1 7 30. I
1 7 40. I
1 7 50. I
1 7 60. I
1 8 10. I
1 8 20. I
1 8 30. I
1 8 40. I
1 8 50. I
1 8 60. I
1 9 10. I
1 9 20. I

RUNOFF MULTIPLIED BY 0.50

0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	4.	8.	12.
17.	21.	24.	26.	27.	28.	29.	30.	30.	30.
30.	30.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
31.	31.	35.	48.	74.	109.	144.	173.	194.	212.
228.	244.	257.	268.	277.	287.	301.	316.	330.	342.
362.	407.	483.	502.	663.	766.	812.	812.	765.	685.
596.	522.	468.	426.	391.	360.	334.	314.	295.	267.
228.	181.	134.	95.	69.	50.	37.	28.	22.	17.
14.	12.	10.	9.	8.	8.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.						

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	812.	398.	113.	113.	16234.
INCHES		8.22	9.32	9.32	9.32
AC-FT		197.	224.	224.	224.


1 20 50.1
1 20 60.1
1 21 10.1
1 21 20.1
1 21 30.1
1 21 40.1
1 21 50.1
1 21 60.1
1 22 10.1
1 22 20.1
1 22 30.1
1 22 40.1
1 22 50.1
1 22 60.1
1 23 10.1
1 23 20.1
1 23 30.1
1 23 40.1
1 23 50.1
1 23 60.1
LX



OVF

STATION 3

INFLOW*I<, OUTFLOW*O< AND OBSERVED FLOW*#<

	0.	200.	400.	600.	800.	1000.	1200.	1400.	1600.	1800.	0.	0.	0.
											PRECIP*L< AND EXCESS*X<		
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.8	0.4	0.0
1	0 10	I											L
1	0 20	I											L
1	0 30	I											L
1	0 40	I											L
1	0 50	I											L
1	0 60	I											L
1	1 10	I											L
1	1 20	I											L
1	1 30	I											L
1	1 40	I											L
1	1 50	I											L
1	1 60	I											L
1	2 10	I											L
1	2 20	I											L
1	2 30	I											L
1	2 40	I											L
1	2 50	I											L
1	2 60	I											L
1	3 10	I											L
1	3 20	I											L
1	3 30	I											L
1	3 40	I											L
1	3 50	I											L
1	3 60	I											L
1	4 10	I											L
1	4 20	I											L
1	4 30	I											L
1	4 40	I											L
1	4 50	I											L
1	4 60	I											L
1	5 10	I											L
1	5 20	I											L
1	5 30	I											L
1	5 40	I											L
1	5 50	I											L
1	5 60	I											L
1	6 10	I											LX
1	6 20	I											LX
1	6 30	.I											LX
1	6 40	.I											LX
1	6 50	. I											LX
1	6 60	. I											LX
1	7 10	. I											LX
1	7 20	. I											LX
1	7 30	. I											LX
1	7 40	. I											LX
1	7 50	. I											LX
1	7 60	. I											LX
1	8 10	. I											LX
1	8 20	. I											LX
1	8 30	. I											LX
1	8 40	. I											LX
1	8 50	. I											LX
1	8 60	. I											LX

1	15	30	1.12	1.11	966.
1	15	40	1.12	1.11	1165.
1	15	50	1.12	1.11	1367.
1	15	60	1.12	1.11	1531.
1	16	10	0.41	0.40	1624.
1	16	20	0.41	0.40	1624.
1	16	30	0.41	0.40	1530.
1	16	40	0.41	0.40	1370.
1	16	50	0.41	0.40	1192.
1	16	60	0.41	0.40	1044.
1	17	10	0.33	0.31	937.
1	17	20	0.33	0.31	852.
1	17	30	0.33	0.31	781.
1	17	40	0.33	0.31	719.
1	17	50	0.33	0.31	667.
1	17	60	0.33	0.31	628.
1	18	10	0.03	0.01	590.
1	18	20	0.03	0.01	535.
1	18	30	0.03	0.01	456.
1	18	40	0.03	0.01	361.
1	18	50	0.03	0.01	267.
1	18	60	0.03	0.01	191.
1	19	10	0.03	0.01	137.
1	19	20	0.03	0.01	101.
1	19	30	0.03	0.01	75.
1	19	40	0.03	0.01	56.
1	19	50	0.03	0.01	43.
1	19	60	0.03	0.01	34.
1	20	10	0.03	0.01	28.
1	20	20	0.03	0.01	24.
1	20	30	0.03	0.01	21.
1	20	40	0.03	0.01	18.
1	20	50	0.03	0.01	17.
1	20	60	0.03	0.01	16.
1	21	10	0.03	0.01	15.
1	21	20	0.03	0.01	15.
1	21	30	0.03	0.01	15.
1	21	40	0.03	0.01	15.
1	21	50	0.03	0.01	15.
1	21	60	0.03	0.01	15.
1	22	10	0.03	0.01	15.
1	22	20	0.03	0.01	15.
1	22	30	0.03	0.01	15.
1	22	40	0.03	0.01	15.
1	22	50	0.03	0.01	15.
1	22	60	0.03	0.01	15.
1	23	10	0.03	0.01	15.
1	23	20	0.03	0.01	15.
1	23	30	0.03	0.01	15.
1	23	40	0.03	0.01	15.
1	23	50	0.03	0.01	15.
1	23	60	0.03	0.01	15.
		SUM	21.36	19.02	32469.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1624.	795.	225.	225.	32468.
INCHES		16.44	18.64	18.64	18.64
AC-FT		394.	447.	447.	447.

1	4	30	0.02	0.00	3.
1	4	40	0.02	0.00	3.
1	4	50	0.02	0.00	3.
1	4	60	0.02	0.00	3.
1	5	10	0.02	0.00	3.
1	5	20	0.02	0.00	3.
1	5	30	0.02	0.00	3.
1	5	40	0.02	0.00	3.
1	5	50	0.02	0.00	3.
1	5	60	0.02	0.00	3.
1	6	10	0.05	0.04	4.
1	6	20	0.05	0.04	8.
1	6	30	0.05	0.04	15.
1	6	40	0.05	0.04	25.
1	6	50	0.05	0.04	34.
1	6	60	0.05	0.04	42.
1	7	10	0.05	0.04	48.
1	7	20	0.05	0.04	52.
1	7	30	0.05	0.04	55.
1	7	40	0.05	0.04	57.
1	7	50	0.05	0.04	58.
1	7	60	0.05	0.04	59.
1	8	10	0.05	0.04	60.
1	8	20	0.05	0.04	60.
1	8	30	0.05	0.04	61.
1	8	40	0.05	0.04	61.
1	8	50	0.05	0.04	61.
1	8	60	0.05	0.04	61.
1	9	10	0.05	0.04	61.
1	9	20	0.05	0.04	61.
1	9	30	0.05	0.04	61.
1	9	40	0.05	0.04	61.
1	9	50	0.05	0.04	61.
1	9	60	0.05	0.04	61.
1	10	10	0.05	0.04	61.
1	10	20	0.05	0.04	61.
1	10	30	0.05	0.04	61.
1	10	40	0.05	0.04	61.
1	10	50	0.05	0.04	61.
1	10	60	0.05	0.04	61.
1	11	10	0.05	0.04	61.
1	11	20	0.05	0.04	61.
1	11	30	0.05	0.04	61.
1	11	40	0.05	0.04	61.
1	11	50	0.05	0.04	61.
1	11	60	0.05	0.04	61.
1	12	10	0.30	0.28	69.
1	12	20	0.30	0.28	97.
1	12	30	0.30	0.28	149.
1	12	40	0.30	0.28	217.
1	12	50	0.30	0.28	288.
1	12	60	0.30	0.28	346.
1	13	10	0.36	0.34	388.
1	13	20	0.36	0.34	424.
1	13	30	0.36	0.34	457.
1	13	40	0.36	0.34	488.
1	13	50	0.36	0.34	515.
1	13	60	0.36	0.34	536.
1	14	10	0.44	0.43	554.
1	14	20	0.44	0.43	575.
1	14	30	0.44	0.43	601.
1	14	40	0.44	0.43	631.
1	14	50	0.44	0.43	661.
1	14	60	0.44	0.43	685.
1	15	10	1.12	1.11	724.

OVN

SUB-AREA RUNOFF COMPUTATION

PROBABLE MAXIMUM 24-HOUR PRECIPITATION (SOUTH RE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
3	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	0.45	0.0	0.45	1.00	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.0	16.00	111.00	123.00	133.00	0.0	0.0	0.0

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.0	0.0	1.00	0.0	0.0	1.00	0.34	0.12	0.0	0.10

UNIT HYDROGRAPH DATA

TP= 0.67 CP=0.68 NTA= 0

RECESSION DATA

STRTQ= 0.0 QRCSN= 0.0 RTIOR= 1.00

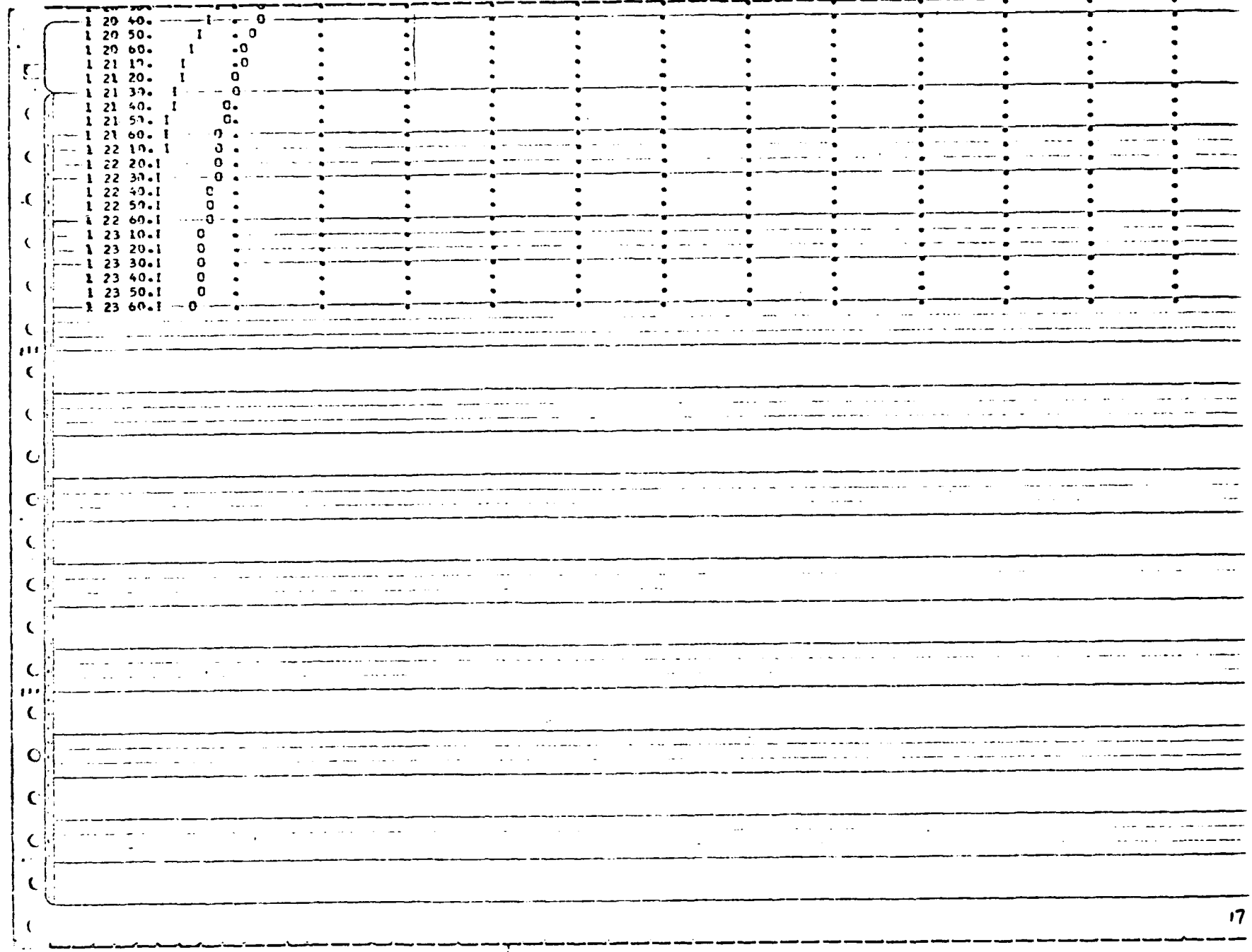
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 4.59 AND R= 2.90 INTERVALS

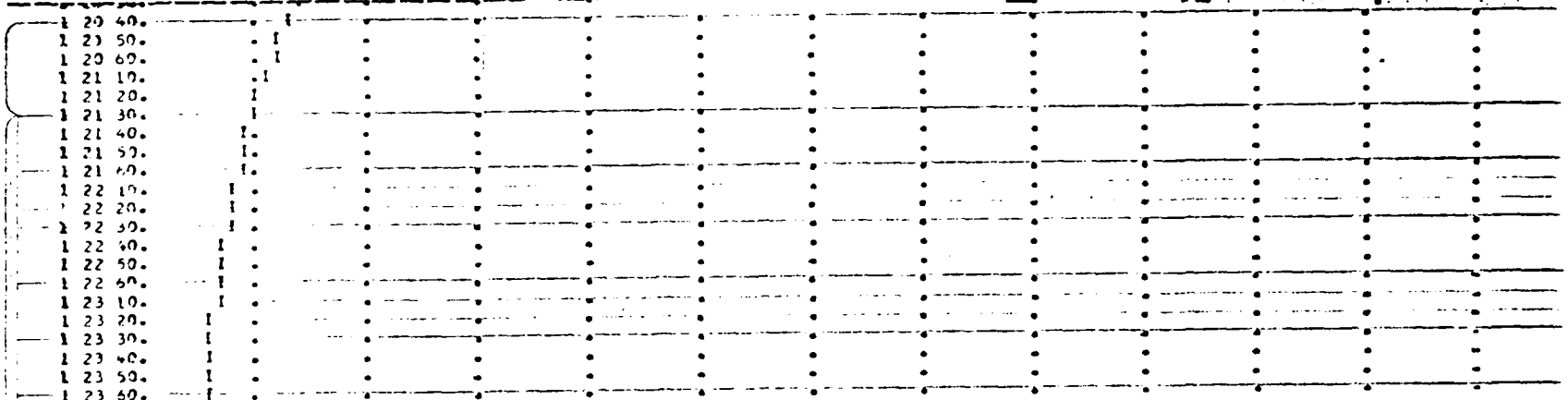
UNIT HYDROGRAPH 19 END-OF-PERIOD ORDINATES, LAG= 0.67 HOURS, CP= 0.68 VOL= 1.00

32.	115.	213.	283.	291.	237.	166.	116.	83.	59.
42.	29.	21.	15.	10.	7.	5.	4.	3.	

END-OF-PERIOD FLOW

	TIME	RAIN	EXCS	COMP Q
1	0 10	0.02	0.00	0.
1	0 20	0.02	0.00	0.
1	0 30	0.02	0.00	1.
1	0 40	0.02	0.00	1.
1	0 50	0.02	0.00	2.
1	0 60	0.02	0.00	2.
1	1 10	0.02	0.00	2.
1	1 20	0.02	0.00	3.
1	1 30	0.02	0.00	3.
1	1 40	0.02	0.00	3.
1	1 50	0.02	0.00	3.
1	1 60	0.02	0.00	3.
1	2 10	0.02	0.00	3.
1	2 20	0.02	0.00	3.
1	2 30	0.02	0.00	3.
1	2 40	0.02	0.00	3.
1	2 50	0.02	0.00	3.
1	2 60	0.02	0.00	3.
1	3 10	0.02	0.00	3.
1	3 20	0.02	0.00	3.
1	3 30	0.02	0.00	3.
1	3 40	0.02	0.00	3.
1	3 50	0.02	0.00	3.
1	3 60	0.02	0.00	3.
1	4 10	0.02	0.00	3.


1 20 40. I 0
1 20 50. I 0
1 20 60. I 0
1 21 10. I 0
1 21 20. I 0
1 21 30. I 0
1 21 40. I 0.
1 21 50. I 0.
1 21 60. I 0
1 22 10. I 0
1 22 20.I 0
1 22 30.I 0
1 22 40.I 0
1 22 50.I 0
1 22 60.I 0
1 23 10.I 0
1 23 20.I 0
1 23 30.I 0
1 23 40.I 0
1 23 50.I 0
1 23 60.I 0


1 20 40.
1 20 50.
1 20 60.
1 21 10.
1 21 20.
1 21 30.
1 21 40.
1 21 50.
1 21 60.
1 22 10.
1 22 20.
1 22 30.
1 22 40.
1 22 50.
1 22 60.
1 23 10.
1 23 20.
1 23 30.
1 23 40.
1 23 50.
1 23 60.

OVN

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

PULS RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
5	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
0	0	0	0.0	0.0	0.0	-1.

STORAGE#	322.	417.	441.	458.	475.	492.	509.	526.	543.	560.
OUTFLOW#	0.	0.	55.	125.	210.	310.	765.	2360.	4790.	7745.

		TIME	EOP STOR	AVG IN	EOP OUT
1	0	10	417.	0.	0.
1	0	20	417.	0.	0.
1	0	30	417.	0.	0.
1	0	40	417.	0.	0.
1	0	50	417.	1.	0.
1	0	60	417.	1.	0.
1	1	10	417.	1.	0.
1	1	20	417.	1.	0.
1	1	30	417.	1.	0.
1	1	40	417.	1.	0.
1	1	50	417.	1.	0.
1	1	60	417.	1.	0.
1	2	10	417.	1.	0.
1	2	20	417.	1.	0.
1	2	30	417.	1.	0.
1	2	40	417.	1.	0.
1	2	50	417.	1.	0.
1	2	60	417.	1.	1.
1	3	10	417.	1.	1.
1	3	20	417.	1.	1.
1	3	30	417.	1.	1.
1	3	40	417.	1.	1.
1	3	50	417.	1.	1.
1	3	60	417.	1.	1.
1	4	10	417.	1.	1.
1	4	20	417.	1.	1.
1	4	30	417.	1.	1.
1	4	40	417.	1.	1.
1	4	50	417.	1.	1.
1	4	60	417.	1.	1.
1	5	10	417.	1.	1.
1	5	20	417.	1.	1.
1	5	30	417.	1.	1.
1	5	40	417.	1.	1.
1	5	50	417.	1.	1.
1	5	60	417.	1.	1.
1	6	10	417.	2.	1.
1	6	20	417.	3.	1.
1	6	30	418.	6.	1.
1	6	40	418.	10.	1.

1	6	60	418.	20.	2.
1	7	10	418.	23.	3.
1	7	20	419.	26.	4.
1	7	30	419.	28.	5.
1	7	40	419.	30.	5.
1	7	50	420.	32.	6.
1	7	60	420.	33.	7.
1	8	10	420.	34.	8.
1	8	20	421.	35.	9.
1	8	30	421.	36.	10.
1	8	40	422.	37.	10.
1	8	50	422.	39.	11.
1	8	60	422.	40.	12.
1	9	10	423.	41.	13.
1	9	20	423.	44.	14.
1	9	30	424.	46.	15.
1	9	40	424.	49.	16.
1	9	50	424.	51.	17.
1	9	60	425.	54.	18.
1	10	10	426.	57.	19.
1	10	20	426.	59.	21.
1	10	30	427.	61.	22.
1	10	40	427.	64.	23.
1	10	50	428.	66.	25.
1	10	60	428.	68.	26.
1	11	10	429.	71.	27.
1	11	20	430.	73.	29.
1	11	30	430.	75.	30.
1	11	40	431.	77.	32.
1	11	50	431.	79.	33.
1	11	60	432.	81.	35.
1	12	10	433.	85.	36.
1	12	20	434.	96.	38.
1	12	30	435.	118.	40.
1	12	40	436.	151.	44.
1	12	50	438.	190.	48.
1	12	60	441.	227.	54.
1	13	10	443.	259.	65.
1	13	20	446.	286.	77.
1	13	30	450.	316.	90.
1	13	40	453.	344.	104.
1	13	50	457.	376.	119.
1	13	60	460.	411.	137.
1	14	10	465.	446.	158.
1	14	20	469.	483.	179.
1	14	30	473.	523.	202.
1	14	40	478.	567.	229.
1	14	50	483.	614.	259.
1	14	60	489.	663.	291.
1	15	10	494.	717.	366.
1	15	20	499.	806.	503.
1	15	30	504.	941.	639.
1	15	40	510.	1176.	871.
1	15	50	516.	1526.	1341.
1	15	60	520.	1885.	1783.
1	16	10	523.	2196.	2111.
1	16	20	526.	2454.	2384.
1	16	30	528.	2652.	2646.
1	16	40	529.	2813.	2810.
1	16	50	530.	2982.	2980.
1	16	60	531.	3061.	3060.
1	17	10	530.	3003.	3004.
1	17	20	530.	2868.	2890.
1	17	30	529.	2742.	2744.
1	17	40	527.	2582.	2584.

1	17	60	526.	2354.	2362.
1	18	10	525.	2259.	2261.
1	18	20	524.	2151.	2178.
1	18	30	523.	2025.	2057.
1	18	40	521.	1883.	1919.
1	18	50	520.	1731.	1770.
1	18	60	516.	1578.	1617.
1	19	10	516.	1428.	1467.
1	19	20	515.	1283.	1321.
1	19	30	513.	1144.	1180.
1	19	40	512.	1010.	1045.
1	19	50	511.	885.	918.
1	19	60	509.	770.	801.
1	20	10	508.	668.	738.
1	20	20	506.	593.	692.
1	20	30	505.	553.	649.
1	20	40	503.	529.	612.
1	20	50	502.	503.	578.
1	20	60	501.	476.	546.
1	21	10	500.	450.	516.
1	21	20	499.	423.	487.
1	21	30	498.	400.	460.
1	21	40	497.	382.	436.
1	21	50	496.	368.	415.
1	21	60	495.	354.	396.
1	22	10	495.	341.	379.
1	22	20	494.	327.	363.
1	22	30	493.	314.	348.
1	22	40	493.	301.	333.
1	22	50	492.	290.	320.
1	22	60	492.	279.	309.
1	23	10	491.	269.	306.
1	23	20	491.	260.	303.
1	23	30	490.	251.	298.
1	23	40	489.	242.	294.
1	23	50	488.	233.	289.
1	23	60	488.	225.	284.
		SUM			69185.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3060.	1665.	480.	480.	69185.
INCHES		6.81	7.84	7.84	7.84
AC-FT		828.	953.	953.	953.

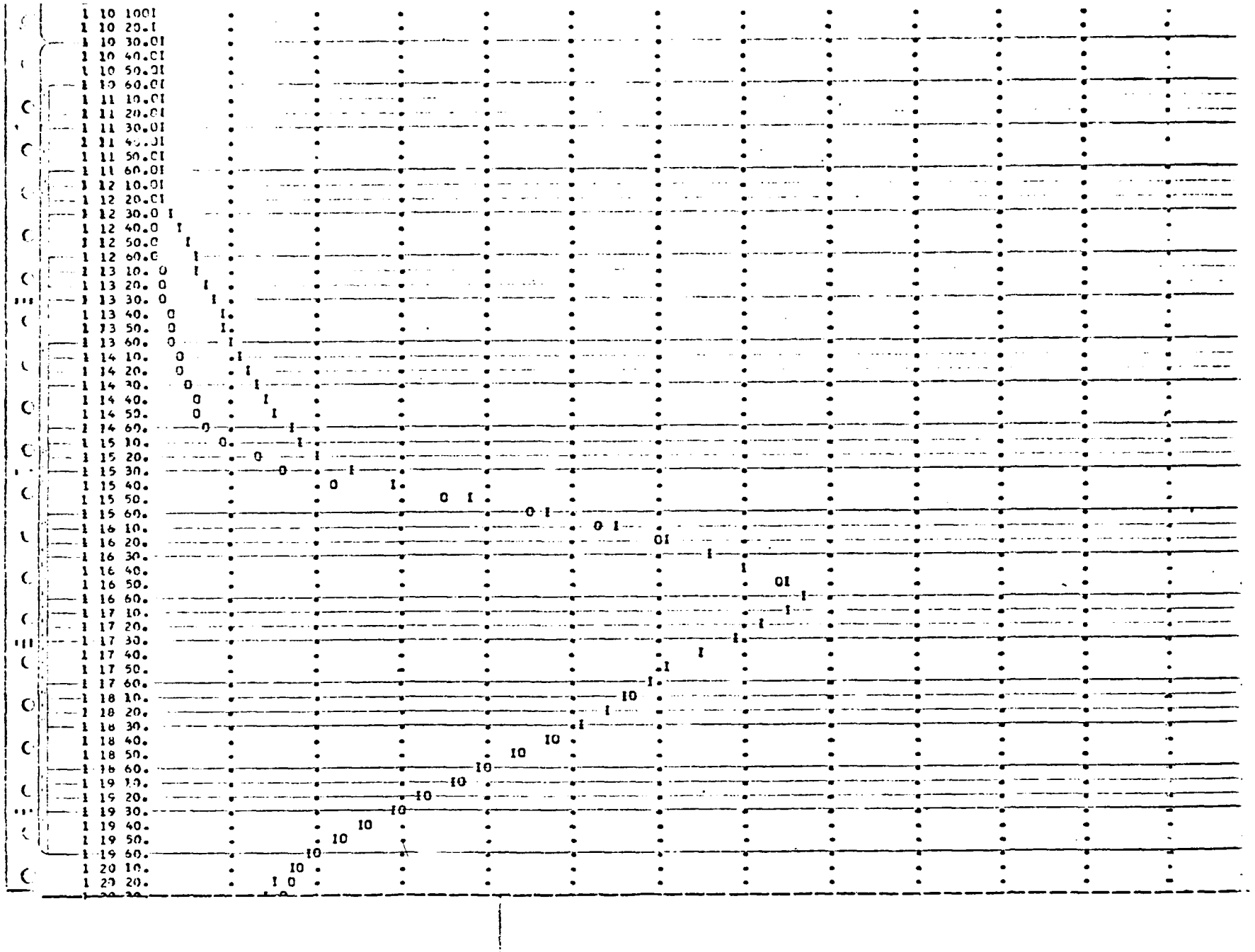
OVF

STATION 5

INFLOW#1<, OUTFLOW#0< AND OBSERVED FLOW#*<

0. 400. 800. 1200. 1600. 2000. 2400. 2800. 3200. 0. 0. 0. 1.

1 0 101
1 0 201
1 0 301
1 0 401
1 0 501
1 0 601
1 1 101
1 1 201
1 1 301
1 1 401
1 1 501
1 1 601
1 2 101
1 2 201
1 2 301
1 2 401
1 2 501
1 2 601
1 3 101
1 3 201
1 3 301
1 3 401
1 3 501
1 3 601
1 4 101
1 4 201
1 4 301
1 4 401
1 4 501
1 4 601
1 5 101
1 5 201
1 5 301
1 5 401
1 5 501
1 5 601
1 6 101
1 6 201
1 6 301
1 6 401
1 6 501
1 6 601
1 7 1001
1 7 2001
1 7 3001
1 7 4001
1 7 5001
1 7 6001
1 8 1001
1 8 2001
1 8 3001
1 8 4001
1 8 5001
1 8 6001
1 9 1001
1 9 2001


1 10 100I
1 10 20.I
1 10 30.0I
1 10 40.0I
1 10 50.0I
1 10 60.0I
1 11 10.0I
1 11 20.0I
1 11 30.0I
1 11 40.0I
1 11 50.0I
1 11 60.0I
1 12 10.0I
1 12 20.0I
1 12 30.0 I
1 12 40.0 I
1 12 50.0 I
1 12 60.0 I
1 13 10. 0 I
1 13 20. 0 I
1 13 30. 0 I
1 13 40. 0 I.
1 13 50. 0 I.
1 13 60. 0 I
1 14 10. 0 I
1 14 20. 0 I
1 14 30. 0 I
1 14 40. 0 I
1 14 50. 0 I
1 14 60. 0 I
1 15 10. 0 I
1 15 20. 0 I
1 15 30. 0 I
1 15 40. 0 I.
1 15 50. 0 I
1 15 60. 0 I
1 16 10. 0 I
1 16 20. 0I
1 16 30. I
1 16 40. I
1 16 50. 0I
1 16 60. I
1 17 10. I
1 17 20. I
1 17 30. I
1 17 40. I
1 17 50. I
1 17 60. I
1 18 10. 10
1 18 20. I
1 18 30. I
1 18 40. 10
1 18 50. 10
1 18 60. 10
1 19 10. 10
1 19 20. 10
1 19 30. 10
1 19 40. 10
1 19 50. 10
1 19 60. 10
1 20 10. 10
1 20 20. I 0

```
1 21 30.      10
1 21 40.      10
1 21 50.      10
1 21 60.      10
1 22 10.      1.
1 22 20.      10.
1 22 30.      10.
1 22 40.      1 .
1 22 50.      10 .
1 22 60.      10 .
1 23 10.      10 .
1 23 20.      1 0 .
1 23 30.      10  .
1 23 40.      10  .
1 23 50.      10  .
1 23 60.      10  .
```

RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	2568.	1525.	451.	451.	1.83
ROUTED TO	2	2528.	1372.	403.	403.	1.83
HYDROGRAPH AT	3	612.	398.	113.	113.	0.45
2 COMBINED	4	3073.	1695.	516.	516.	2.28
ROUTED TO	5	3060.	1669.	480.	480.	2.28

APPENDIX E

Information as Contained in the National Inventory of Dams

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGRESS DIST.	STATE	COUNTY	CONGRESS DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	DAY	MO	YR
VT	58	NED	VT	011	01				SAINT ALBANS RESERVOIR DAM (NORTH)	4445.5	7303.8	29	SEP	78

POPULAR NAME	NAME OF IMPOUNDMENT
	SAINT ALBANS RESERVOIR (NORTH)

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
02	01	MILL RIVER	NORTH FAIRFAX	0	40

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPG	1895		35	27	1168	850	NED	N	N	N	N	020CT78

REMARKS

O/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	1200	U	25	385	1371300											

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF SAINT ALBANS		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
WATER RESOURCES BD	WATER RESOURCES BD	WATER RESOURCES BD	WATER RESOURCES BD

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
DUFRESNE-HENRY ENG CORP	03	AUG	78	P.L. 92-367

REMARKS

END

FILMED

9-85

DTIC